# THE VALUE OF INFUSING SELF-EFFICACY THEORY WITH SMARTPHONE TECHNOLOGY TO SUSTAIN WALKING FOR EXERCISE IN A WORKSITE POPULATION

by

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A dissertation submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Health Promotion and Education

The University of Utah

August 2013

**The University of Utah Graduate School**

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# ABSTRACT

With the health care focus shifting from chronic disease management to efforts around preventative care, worksites may be a key population for interventions to improve health. Because walking is commonly utilized in worksite wellness programs (WWP) and self-efficacy is a strong predictor of exercise adherence, the purpose of this study is to determine the value of incorporating the self-efficacy theory with technology to increase and sustain walking for exercise behavior in a healthcare worksite population.

This study, consisting of two parts, seeks to answer the following research questions: Will messages based upon the self-efficacy theory delivered during a 1-mile walk significantly increase beliefs around walking for exercise? Will a smartphone application plus self-efficacy messages delivered via text message increase self-efficacy beliefs as well as sustain walking behavior? Do self-efficacy beliefs associated with walking transfer to other forms of physical activity?

A pilot study consisting of a one-group, mixed methods, pre-post test nonexperimental design ($N$=16) tested the delivery of self-efficacy messages as well as a tool to measure walking self-efficacy beliefs. These beliefs were measured before and after a 1-mile walking session during which verbal self-efficacy messages were delivered. Paired $t$-test analysis confirmed that self-efficacy beliefs significantly improved.

The sustainability study, a two-group randomized control true experimental design, incorporated smartphone technology for tracking walking behavior over 6 weeks

and delivery of text messages (*N*=73). Both groups used a smartphone application to track their walks and the intervention group received weekly text messages based upon the self-efficacy theory.

Self-efficacy beliefs increased significantly within each group, but there was not a significant difference between groups at posttest, which means that the smartphone application and monitoring of behavior may have increased beliefs, but the text messages did not have a significant effect. There was value in the text messages for behavior change as the intervention group sustained the walking behavior one week longer than the control group. While this study design is a novel approach to improving the walking for exercise behavior of worksite population, it should not be used as a sole intervention and instead be combined with other modalities to create a multifaceted WWP.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Table Page

# ACKNOWLEDGMENTS

I cannot take full credit for this accomplishment, nor would I ever try. My family and my husband have had as much to do with my success as I have. They have stood behind me, cheered me on and supported me through it all. I am grateful for their faith in me and their belief in my abilities. My husband has been my rock with his unwavering support and confidence in me. I appreciate him hanging in there these past few years as his encouragement and understanding have meant the world to me.

I would also like to thank my chair, Dr. Eric Trunnell, for his feedback and guidance – especially when I needed help to see the forest from the trees. He helped me take a step back and review my work with new eyes – even when I resisted. I also owe much thanks to my committee: Dr.'s Maria Newton, Steve Alder, Karol Kumpfer and Nick Galli – their faith and advice have taken me far beyond what I ever imagined. Their confidence in me built my own self-efficacy and helped me accomplish more than I ever could have imagined.

I would also like to thank Greg Stoddard – his patience in helping me with my statistics was unbelievable. There is no way I could have done this without his help. My mentor and friend, Teri Olsen always reminded me I could do anything I wanted and helped me stand tall even when I was feeling defeated.

I owe thanks to these people as well as to all of my colleagues and friends. They all remind me of my favorite fortune cookie: “Many a false step is made by standing still.” Thank you to everyone - I never stood still because of your faith and support.

# CHAPTER 1

# INTRODUCTION

Preliminary results from the 2011 National Vital Statistics Report states that diseases of the heart still continue to be the leading cause of death among Americans, accounting for 173.7 age-adjusted deaths per 100,000 population (Hoyert & Xu, 2012). Other preventable diseases such as chronic lower respiratory disease, diabetes mellitus, and hypertension are still on the list accounting for over 70 age-adjusted deaths per 100,000 population. While evidence is clear that physical activity is beneficial to health and wellness, HealthyPeople 2020 reports that only 43.5% of adults meet the established physical activity guidelines of performing between 150 to 300 minutes of moderate-intensity activity each week (U.S. Department of Health and Human Services, 2008) and that 36.2% of adults engage in no leisure-time physical activity (HealthyPeople.gov, 2011). Increasing these percentages is a focus of the National Prevention Strategy, which was created by the National Prevention Council following passage of the Affordable Care Act. The Strategy outlines key partners and strategies concentrated on improving the health of U.S. adults, decreasing health care costs and increasing health care access (National Prevention Council, 2011).

The benefits of regular physical activity have been repeatedly cited in research (Bize, Johnson, & Plotnikoff, 2007; Conn, Hafdahl, Cooper, Brown, & Lusk, 2009; Teychenne, Ball, & Salmon, 2008). In addition to personal health benefits, improved health can also positively affect workplace attendance, decrease job stress, reduce risk of diabetes and increase physical fitness (Conn et al., 2009). Focusing on wellness in the worksite brings additional benefits to employers such as increased productivity, reduced medical claims, and employee turnover (Lechner & De Vries, 1995; Stoffelmayr et al., 1992; Webber & Mercure, 2010). Because of the social nature of humans, participation

in worksite wellness programs (WWP) may also affect the employee's families and friends as well as lead to improved health and wellness of a community.

## Worksite Health and Wellness Programs

Although worksite health and wellness programs have been around for many years, less than 50% of employees participate and adherence rates are usually no more than 50% at 3 to 6 months postenrollment (Lechner & De Vries, 1995; S. J. Robroek, van Lenthe, van Empelen, & Burdorf, 2009; Stoffelmayr et al., 1992). There have been a few studies focused upon adherence rates and factors, but most are more than 20 years old. The population of employees who participate in WWPs may be skewed by employees who do not need external encouragement (Leininger, Harris, Tracz, & Marshall, 2013), are the most compliant ones or ones who are already physically active (Aittasalo, Rinne, Pasanen, Kukkonen-Harjula, & Vasankari, 2012), or employees with low intention to participate do not enroll (Robroek, Lindeboom, & Burdorf, 2012). In one study on participation, Steinhardt and Carrier (1989) suggest that focus on attitudinal commitment is important because while employees believe they should exercise they do not necessarily turn those beliefs into action.

In addition to studying participation and adherence, other research has been conducted on identifying the barriers to participating in worksite exercise programs. One study found that time/motivation, attitudes about exercise, embarrassment with exercising in fitness centers and cost in joining fitness centers were barriers (Schwetschenau, O'Brien, Cunningham, & Jex, 2008). Some occupations, such as healthcare, may also have structural barriers to participation. Based upon the American Time Use Survey (U.S. Department of Labor, 2008), 39% of people employed as healthcare support and

35% as practitioners worked on average a weekend day as compared to only 31% of those in nonhealthcare occupations. Additionally, both healthcare occupations also worked longer than those in nonhealthcare on weekend days and for those employed fulltime, they were more likely to work between the hours of 10 p.m. and 5 a.m. which can make it difficult to participate in traditional wellness programs.

## Walking for Exercise

A common emphasis of comprehensive WWPs is increasing or sustaining physical activity behavior. Lifestyle activities such as walking are a form of physical activity that is easily adapted into everyday life and has been a focus of WWPs in the past. Walking is popular among adults because of its accessibility, easily controlled intensity and is inexpensive and familiar (Ekkekakis, Backhouse, Gray, & Lind, 2008). It has also been suggested that there may be higher adherence to walking than more vigorous activities, making walking a choice form of physical activity (Lamb et al.; Parkkari et al. as referenced by Ekkekakis et al. (2008)).

Because of the diverse schedules of healthcare workers and the need to find ways to easily incorporate physical activity into their busy lives, walking is a form of exercise that can be performed in as little as 10 minutes at a time (Murphy, Nevill, Neville, Biddle, & Hardman, 2002) at lunch and during breaks, by parking further from the office and can also be done with friends, family and even a pet.

## Self-Efficacy Theory

A study conducted on healthcare workers' needs with regard to worksite wellness programs suggested that the use of the self-efficacy theory by Albert Bandura may

provide improved outcomes (Flannery, Resnick, Galik, & Lipscomb, 2011). In addition, one study observed that self-efficacy was repeatedly associated with walking (Hovell et al., 1989). Self-efficacy is the confidence a person has in her ability to perform a behavior in a given situation. Self-efficacy is influenced by four sources: mastery experiences, social modeling, verbal persuasion and emotional arousal or physiological factors (Bandura, 1997). The most effective influence is *mastery experiences*. Also called *enactive mastery*, this source of influence develops self-efficacy through success at a task or skill and weakens self-efficacy with failure. Self-efficacy is increased through goal setting and practice, especially if the person feels she continually improves in her ability to execute the behavior.

*Social modeling* is a way to increase self-efficacy beliefs by comparing one's capabilities to another person's abilities. This is sometimes called *vicarious experience* in that the person "lives" the action through another and builds her own beliefs that she can attain the same success herself.

A third source of influence is *verbal persuasion* though which messages can be used to persuade a person she has what it takes to succeed. Structuring the environment and activities to support success and being aware of the person's skill level and weaknesses is an important aspect of this modality.

*Physiological* and *emotional responses* before, during and after the activity or situation also affect a person's self-efficacy beliefs. Learning how to curtail these feelings and emotions is a way to increase efficacy beliefs.

## Self-Efficacy Theory and Messages

Studies have found that the use of self-efficacy-based messages and materials can significantly increase exercise adherence (Bock, Marcus, Pinto, & Forsyth, 2001; McAuley & Blissmer, 2000; Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005). Rovniak et al. (2005) tested theoretical fidelity of an e-mail-based walking program grounded in Bandura's self-efficacy theory and found a significant difference between the group who received high fidelity messages as opposed to the group receiving low fidelity or loosely-based theoretical messages. They concluded that studies closely replicating theoretical recommendations could improve behavior change interventions.

E-mail is one way to deliver messages to a population but with the increased use of mobile phones, text message systems are increasing in popularity. A review article by Fjeldsoe, Marshall, and Miller (2009) outlined behavior change interventions that were delivered through Short-Message Service (SMS) or text messages on the mobile phone. They found that 13 of the 14 studies had positive behavior change outcomes suggesting that the use of personalized text messages may affect short-term behavior change.

## Smartphone Apps

Because our country has become increasingly electronically connected, the use of computers, the Internet, e-mail and mobile phones is emerging as health-based intervention methods. A review article by Nigg (2003) identified the technology impact upon physical activity over the past few years along with ways technology can support health behavior change. One example he gave is "expert systems" which have been developed to mimic the reasoning of human experts, allowing a computer to give tailored feedback to an individual following a set of assessments. While a computer is typically

stationary, we now have mobile phones called smartphones that can do the same thing as a computer but are portable giving us another avenue to influence behavior change.

A smartphone is a mobile phone with PC-like capabilities such as accessing the World Wide Web, email and applications (apps). These apps are computer programs that can do a variety of behaviors such as gaming, computing data and immediately responding to requests initiated by the user. There is an expansive selection of app types available, from productivity apps to games. One type, health and fitness, has proliferated with over 10,000 apps available between the iTunes App Store and Google Android Market (U.S. Department of Health and Human Services (HHS) Text4Health Task Force, n.d.). There have been studies that have used cell phone apps for physical activity-based interventions (Liu et al., 2008; Taylor & Katomeri, 2007), but minimal research has been published for use of apps to increase and maintain the physical activity guidelines for Americans in the worksite population.

Coupling this app and text message technology with self-efficacy theory based messages is one way to reach the worksite population. Therefore the purpose of this study is to evaluate the value of self-efficacy theoretical messages delivered via text message in conjunction with walking for exercise activity tracked by a smartphone app. This approach to worksite wellness allows for a virtual connection to the participants as well as participant self-control over their walking exercise during and outside of work.

## Study Aims and Objectives

### Purpose of this Study

Because of new possibilities with current and emerging technology, the *Self-Efficacy and Smartphone Model* was developed to help health educators and coaches in

assisting employees with behavior change. This new model outlines how to use health and fitness apps along with text-messages based on the self-efficacy theory to promote walking for exercise behavior. In addition, the model explains how social media can promote collective efficacy and as well as participation of more employees in walking for exercise.

The purpose of this study is to utilize the *Self-Efficacy and Smartphone Model* to promote walking for exercise behavior in a female healthcare worksite population. The study will evaluate the use of self-efficacy messages to increase beliefs related to walking for exercise in addition to increasing and sustaining walking behavior. In addition to the messages, the usefulness of text-messaging and smartphone apps will be evaluated.

The outcomes of this research will be used to determine the value of technology used in conjunction with the self-efficacy theory to increase and sustain adequate amounts of walking in a worksite population. It will contribute innovative thought and application of current technologies with hopes of building the groundwork for further research.

Research Hypotheses

1) Determine if theory-based self-efficacy messages delivered during a 1-mile walk significantly increase a person's self-efficacy in their ability to walk for exercise.

   *Ho*: There will be no change in perceived walking for exercise self-efficacy.

   *Ha*: There will be a significant increase in perceived walking for exercise self-efficacy.

2) Gather administrative data including testing the Walking Self-Efficacy Scale Short Form instrument and self-efficacy messaging techniques.

3) The use of a smartphone exercise app plus enactive mastery and verbal persuasion messages significantly increases walking for exercise self-efficacy beliefs than use of the exercise app alone.

   *Ho*: There will be no difference between groups at posttest.

   *Ha*: The intervention group will have significantly higher self-efficacy beliefs at posttest.

4) The intervention group will have higher mean walking minutes than the control group at the posttest.

   *Ho*: There will be no difference between groups at posttest.

   *Ha*: The intervention group will have significantly higher walking for exercise self-efficacy beliefs at posttest.

5) The use of a smartphone exercise app and self-efficacy messages increases the likeliness to participate in other forms of physical activity beyond walking.

   *Ho*: There will be no difference between groups at posttest.

   *Ha*: The intervention group will have a significantly higher likeliness to participate in other forms of physical activity beyond walking.

## Overview of This Study

This study is composed of two parts: a pilot study and a sustainability study. The pilot study was conducted during the month of August 2012, just prior to the enrollment of the sustainability study. The sustainability study was conducted from September 2012 – Dec 2012.

# Research Methods

## Design

The pilot study was a one-group, mixed-methods, pre-post test nonexperimental design. It tested self-efficacy messages delivered during a 1-mile walk as well as administrative factors such as the use of the researcher-developed Walking Self-Efficacy Scale Short From and structured interviews.

The sustainability study was a two-group (2x2) randomized control true experimental single-blinded study consisting of a control group and experimental group. It incorporated a similar self-efficacy beliefs scale into its design along with a 6-week walking program utilizing a smartphone app and text messages. Both groups tracked their walking for exercise behavior through a smartphone app while the intervention group received weekly text messages.

## Participant Selection Criteria

Female employees between the ages of 35–64 (determined by their calendar year age) at University of Utah Health Care, who worked at least part-time (20 hours per week) were invited to participate. They had to be physically inactive, reporting exercise of less than 150 minutes per week (U.S. Department of Health and Human Services, 2008) and have been healthy enough to participate in a walking program. For those enrolled in the sustainability study, they must have owned a smartphone and been willing to use an app to track their walking for exercise behavior for 6 weeks.

## Introduction to Additional Chapters

*Chapter 2* is a position paper detailing the current state of worksite health and wellness programs, a focus on walking for exercise behavior, the self-efficacy theory, use of messages to influence self-efficacy, latest technology used for health interventions and then an introduction to the novel *Self-Efficacy and Smartphone Model* with suggested future research focus.

*Chapter 3* reports on the first phase of this research project, the pilot study. Data detail the changes seen in self-efficacy beliefs following a 1-mile walk during which theory-based messages were delivered to participants. These results set the stage for the sustainability study reported in Chapter 4.

*Chapter 4* details the results of the sustainability study, which was focused on increasing and sustaining self-efficacy beliefs and walking for exercise behavior. Results from this study can be used as a foundation for future research and development of technology-based, multifaceted worksite health and wellness program interventions.

*Chapter 5* summarizes the results of this study and discusses the implications and recommendations for the future.

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# CHAPTER 2

# INNOVATIVE INTERVENTIONS TO INCREASE WALKING FOR EXERCISE BEHAVIOR IN A WORKSITE POPULATION

FOR SUBMISSION TO *HEALTH PROMOTION PRACTICE*

# INNOVATIVE INTERVENTIONS TO INCREASE WALKING FOR EXERCISE BEHAVIOR IN A WORKSITE POPULATION

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Keywords: worksite, walking, self-efficacy, technology, smartphone, text message

## Abstract

Passage of the Affordable Care Act in 2010 gives companies and institutions of all sizes even more reason to develop strong worksite wellness programs. While many worksite wellness programs have proven to lower costs and improve the health and well being of those engaged, adherence rates are minimal. Since more than half of Americans do not meet the recommended physical activity guidelines (U.S. Department of Health and Human Services, 2008), innovative solutions need to be developed to improve the health of our community. Because smartphone and social media usage continues to increase among all age groups, technology presents an opportunity to create novel interventions for worksite employees. While preliminary research shows promise, very few studies link the use of these technologies to theoretical constructs. This manuscript will discuss specific approaches to apply Albert Bandura's self-efficacy theory and smartphone technology to increase the behavior of walking for exercise within a healthcare worksite population.


## Introduction

The Affordable Care Act (ACA) of 2010 directed the creation of a National Prevention Council tasked with developing a National Prevention Strategy. This strategy was designed to shift the health care focus of the nation away from the existing disease treatment model and towards preventative measures, with a long-term goal to lower health care costs, improve quality of care and provide options for health care coverage to the uninsured (National Prevention Council, 2011). Included in the Act is a focus upon workforce wellness, incentivizing companies to invest in their employees' health through worksite wellness programs (WWP). Health care costs related to chronic disease are

already estimated to be $4.2 trillion annually by 2023 (78% of total health care spending) (Bodenheimer, Chen, & Bennett, 2009) and employers will be expected to provide insurance coverage to employees (Kaiser Family Foundation, 2010), thus investing in comprehensive wellness programs can save the companies money as well as improve the health of the population.

Best practices in WWPs have been researched for years. Some programs have proven successful, but participation levels are less than 50% (median at about 33%) and the typical adherence rate is usually no more than 50% at 3 to 6 months postenrollment (Lechner & De Vries, 1995; Robroek, Van Lenthe, Van Empelen, & Burdorf, 2009; Stoffelmayr et al., 1992). Furthermore, when considering the population of employees who participate in WWPs, the percentages reported may be skewed in terms of those who remain in the program. Sustainers may be employees who do not need external encouragement (Leininger, Harris, Tracz, & Marshall, 2013), are the most compliant ones or ones who are already physically active (Aittasalo, Rinne, Pasanen, Kukkonen-Harjula, & Vasankari, 2012), as well as employees with low intention to participate are less likely to enroll (Robroek, Lindeboom, & Burdorf, 2012). In one study about adherence to WWPs, it is suggested that focus on attitudinal commitment is important because while employees believe they should exercise they do not necessarily turn those beliefs into action (Steinhardt & Carrier, 1989). Thus attention on promoting participation is important, but equally important is researching ways to sustain behavior change long-term.

To increase exercise behavior of a worksite population, consideration should be given to activities that are lifestyle-based, that is, activities that are easily adapted into

everyday life. Walking is an example of a lifestyle activity because it can be adapted into the daily routine such as parking the car further away from work or taking a walk on breaks. Walking is also accessible to most people of all ages regardless of socioeconomic income, skill-level and sex and it has been suggested that there may be higher adherence to walking than more vigorous activities, making walking a choice form of physical activity (Lamb et al.; Parkkari et al. as referenced by Ekkekakis, Backhouse, Gray & Lind (2008)).

Over the years, focus has been placed upon predictors of sustained exercise behavior. McAuley (1992) conducted a 5-month study of middle-aged adults that was based upon a social cognitive framework to determine the role of perceived self-efficacy beliefs with regards to exercise adherence. They found (as confirmed by other studies in literature) that efficacy beliefs played a role in exercise adherence, but that previous behavior proved to be the strongest predictor of sustained exercise adherence. What this means is in addition to increasing self-efficacy beliefs around an exercise behavior, repetition of that behavior with positive results can lead to an eventual "habit." Albert Bandura, author of the self-efficacy theory, explains "with continued practice, skills become fully integrated and are executed with ease. Once proficient modes of behavior become routinized, they no longer require higher cognitive control." (Bandura, 1997, p. 34). This has been seen in studies where self-efficacy beliefs have been realized as a significant predictor of exercise adoption with less significance at the maintenance level (Oman & King, 1998) due to the habitual change in behavior. For moderate intensity exercise, this is true because perceived challenges have been downgraded than in the beginning of an exercise program and so self-efficacy plays a lessor role. With regard to

walking as an exercise behavior, as employees begin incorporating walking for exercise into their days, repetition of the behavior becomes routinized and eventually a lifestyle change has occurred leading to sustained behavior.

As discussed, the self-efficacy theory addresses some of the root issues of motivation and effort that affect behavioral change and offers strategies to address these issues (Bandura, 1997). Key among these strategies is the use of targeted messaging to develop and sustain the desired behavior. The advent of social media (such as Facebook, Twitter, etc.), and smartphones with health and wellness apps offer pervasive technologies available to deliver Bandura's messaging and can be factored into the design of health promotion interventions for WWPs. These technologies, when used under the principles of self-efficacy theory, can tap into the social aspects that support behavior change, and thereby increase individual and collective efficacy. The purpose of this manuscript is to introduce ways to utilize new pervasive technologies, such as social media, text messages and health and wellness apps on smartphones in conjunction with the self-efficacy theory to initiate and sustain walking for exercise behavior in a worksite population.

## Background

### Worksite Wellness Programs

King, Taylor, Haskell, and DeBusk (1990) researched strategies to increase employee activity levels and found that workers prefer convenient, moderate-intensity exercise that can be performed independently, later defined as exercising alone or with family and friends (King & Wilcox, 2008). Walking programs are one way to increase activity because walking can be performed independently, in a group, at work or outside

of work. There has been research focused on improving worksite wellness through pedometer-based walking programs (Faghri et al., 2008; Haines et al., 2007; Hancher-Rauch, Hicks, & VanSickle, 2010). One study incorporated weekly "motivational" emails sent to employees during a 10-week walking program and found significant improvements in level of physical activity and number of steps per week (Faghri et al., 2008). Another study by Haines et al. (2007) coupled pedometers, a computer educational program and weekly e-mails to promote steps taken per day during a 12-week walking program for college faculty and staff. While the researchers were not focused on increased walking behavior, they did find differences in BMI, blood glucose, and total cholesterol between pre- and posttests. They suggested that innovative WWPs need to be developed and that a self-monitoring pedometer program is one way to improve worksite employee health.

Self-Efficacy Theory

Studies have shown that self-efficacy, the confidence one feels in her ability to execute a specific behavior, is a significant predictor of exercise adherence and compliance (McAuley & Blissmer, 2000) and so the chances of increasing and sustaining adequate levels of walking are significantly increased when interventions are based upon the social cognitive theory (SCT) (Bandura, 2002). This theory (which includes the self-efficacy theory by Bandura) is a learning theory. Unlike other health behavior theories and models, this theory does not just concentrate on predicting behavior, but teaches a person how to change their behavior (Bandura, 2004) leading to a greater chance of a lifestyle change. Bandura has detailed four sources to increase a person's self-efficacy:

mastery experience, social modeling (vicarious experiences), social persuasion (verbal persuasion) and through physiological and environmental factors (Bandura, 1997).

The most influential source of self-efficacy is *mastery experience*. Also called *enactive mastery*, mastery experience is when a person gains confidence through goal setting and practice of a behavior. As achievable success occurs, the person builds self-efficacy in her ability to perform the behavior in specific situations.

By observing others through their achievements, a person's self-efficacy can be increased. This is commonly called *vicarious learning*, because a person may "live" through another person and feel more confident in her abilities after watching another person succeed, especially if the person is similar in likeness.

*Social persuasion*, also called *verbal persuasion*, is the delivery of messages to persuade a person she has what it takes to succeed at a task or in a situation. To build the person's confidence, messages are typically delivered prior to an event and are formed based on a person's gains and are only moderately beyond what she perceives she can accomplish.

The last source of influence is a person's perceived *physiological* and *emotional responses* to the situation or event. The feeling of fear, pain or fatigue may be read as signs of low efficacy and so learning how limit these responses is key to increasing self-efficacy.

Messages

One way to operationalize the self-efficacy theory is through messages. Not only can messages be delivered before an event such as with verbal persuasion, they can be delivered during an event, which can enhance the mastery experience of the individual

leading to increased self-efficacy. Messages developed based upon the self-efficacy theory are specific to the person (use their name), the targeted behavior (walking) or skill (stride length) and are delivered at specific times based upon an established goal. They can also be delivered directly or indirectly in a variety of formats (verbal and written). Messages can assist the individual in developing proximal goals, which are goals that mediate action upon what the individual can do here and now. Achievement of proximal goals or subgoals leads to increased self-efficacy through mastery experiences as well as progress towards previously determined distal goals.

Technology is providing an alternative means to health communication and message delivery options. One review article provides suggestions on how to utilize technology to support health behavior change through the use of expert systems (Nigg, 2003). These expert systems are computer programs that mimic human reasoning, providing tailored feedback to individuals based upon a set of assessments. This allows for a new level of message delivery that can be based upon the constructs of the self-efficacy theory as well as delivered virtually. Coupling this technology with self-efficacy messages is one way to consider reaching the worksite population as studies have found that the use of self-efficacy based messages and materials can significantly increase exercise adherence (Bock, Marcus, Pinto, & Forsyth, 2001; McAuley & Blissmer, 2000; Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005).

Smartphone Application and Text-Messages

The self-efficacy theory is about influencing a person's perceived self-efficacy through practice, models, persuasion and management of physiological and emotional factors. As previously discussed, messages are one way to enhance a person's self-

efficacy. Traditionally health-based messages have been delivered though billboards, TV, mail, face-to-face and most recently through the Internet and e-mail. Because billboard and TV messages are generalized to a population, they are unable to be tailored to an individual, thus not meeting the self-efficacy theoretical foundations of personalized messages based upon current and future performance. While face-to face messages are desirable, they are difficult to deliver to a large population. Virtual modes of delivery such as the Internet and e-mail allow for personalized messages that can be delivered any place, anytime, providing a new dimension of message delivery for a large audience. The limitation to this delivery form is that the individual must be connected with a computer or web browser for Internet-delivered messages or able to check her e-mail, and so message receipt could be cumbersome for the receiver. With the advent of smartphones, mobile phone users have additional options for message delivery such as easily accessible e-mail and instant text messaging.

A smartphone is a mobile phone with PC-like capabilities as opposed to the feature phone, which allows for only basic calling and texting capabilities. Because these smartphones function like computers, they run on an operating system, allow the user to surf the web, access e-mail and run programs called applications (apps). Currently, the number of adults ages 16 and over who own smartphones is at 61% (The Neilson Company, 2013) and has multiplied in ownership every year since first developed. Neilson reports that 62% of owners use apps, 63% access social networking sites, and 75% send email from their phones. The number and types of smart phone apps are growing annually, many of which are exercise-related and range in capabilities. Many use an accelerometer and GPS location sensor to track location, distance covered during

an activity, altitude changes and time spent exercising. Others help the user track their food intake through a food diary or help monitor their stress and energy levels.

Smartphones can act as the medium for message delivery, but also can act as an intervention, which makes this technology unique. Smartphones can send and receive synchronous instant text messages as well as e-mail messages. In addition, they can access apps, which can serve a variety of purposes from monitoring and reporting exercise behavior (a form of self-regulation and self-monitoring) to providing education and training.

Even though some studies have been conducted utilizing cell phones for physical activity-based interventions (Liu et al., 2008; Taylor & Katomeri, 2007), there is no research published for use of mobile phone applications or text messages to increase and maintain exercise adherence, particularly walking, for a worksite population built upon the foundations of the self-efficacy theory, thus this is a new and innovative approach to behavior change.

## The Self-Efficacy and Smartphone Model

With the advent of smartphone apps, there are new ways to track exercise behavior with little to no need for manual input by the users. Fitness apps are easily downloaded and are used to track distance, steps taken, pace, calories burned and many other measurements simply by activating the app prior to walking. Some apps allow for a tailored program to be developed to the individual's fitness level and goals, allowing the app to "coach" the individual each time she exercises with her phone.

The *Self-Efficacy and Smartphone Model* (Figure 2.1), developed by the researchers, details how the foundations of the self-efficacy theory can be combined with

smartphone technology to produce sustained walking for exercise behavior change in an individual as well as in a group. The model begins with the individual initiating a walk utilizing her smartphone app to track their behavior as well as connect her to a website where she and a coach can view her activity. Following each walk, the individual easily syncs her activity to the website through her phone's Internet connection, which allows the coach to view the data gathered at any time. Because the data are available virtually, there is no need for the individual to remember to return her logs, as the coach has access to additional data not typically gathered by a pedometer (assuming the individual walks outdoors, using the GPS location sensor capability).

After the coach reviews the day or week's walking activity, she can create theory-driven self-efficacy messages in the form of a text message to be sent to the individual's phone. These messages, as previously described, follow the foundations of Bandura's self-efficacy theory, helping to build self-efficacy and encouraging and motivating the individual in regards to her walking program. The messages can also be tailored to a specific source of influence such as mastery experience (building upon her past experience) and verbal persuasion (future experience and expectations). A study by Patrick et al. (2009) used personalized text-messages as an intervention to help people lose or maintain their weight and found that the intervention group lost more weight than the comparison group. Other studies have used messages as part of a behavior change intervention (Huang, Hung, Chang, & Chang, 2009; Latimer et al., 2008; Parrott, Tennant, Olejnik, & Poudevigne, 2008; Rovniak et al., 2005; Wilbur et al., 2008) and when coupled with experiential learning, significant behavior change occurred (Bennett, Young, Nail, Winters-Stone, & Hanson, 2008; Bock et al., 2001; McAuley & Blissmer,

2000; Parrott et al., 2008; Rovniak et al., 2005). While we are not aware of apps that can mimic human reasoning (such as the previously described computer systems in Nigg's review article), apps are increasing in capabilities and soon, if not already, can analyze the walking behavior of an individual and send text messages based upon the self-efficacy theory to these exercisers through their phones. This can alleviate the need for a coach to facilitate the message creation and delivery and instead be available for other support such as education, planning, goal-setting and problem-solving.

Collective Efficacy and Social Media

Bandura observes that humans do not operate in an isolated environment and that collective efficacy can strongly improve one's success of a desired behavior change along with change in group behavior (Bandura, 1997). Collective efficacy is the shared beliefs of a community that are coordinated and interactive. The social support and bonding creates synergism among its members leading to increased success of the intended behavior. While the *Self-Efficacy and Smartphone Model* can help a single individual, the model can be expanded to include collective efficacy through the inclusion of social media and social persuasion influence. Following a walking activity, the individual may also choose to upload her exercise to a social media site (Facebook, Twitter, etc.) or she may verbally tell colleagues about her exercise activity. Through the influence of vicarious learning, these colleagues experience their friend's success and may become interested and seek assistance from the coach to begin their own walking program. Over time, more persons become involved in the activity through their web of networks. They remain connected through social means (virtually or directly) and influence each other through vicarious experience as well as encouraging each other through their own verbal

persuasion messages. Instead of behavior change being only additive or linear, it becomes much more widespread or multiplicative across groups over time (Figure 2.2), much like the development of the World Wide Web over the past 25 years. The success of one person can influence others to whom they are connected and in return, those people influence those to whom they are connected, creating a widespread web of influence.

With any model, there are limitations. Even though 61% of U.S. adults own a smartphone, not all employees will have access to one, eliminating their ability to use the walking app. In addition, not all adults use text messages or have the funds to pay for them. For those employees who do own a smartphone, educating this population on how to use the app could be difficult. For some employees, an initial meeting to help them set-up their app, link their account to the app's website (for viewing by the coach) and disclosing their mobile phone number for the text messages would need to occur. This could be completed virtually or over the phone although some employees may need additional assistance. Last, depending on the number of employees enrolled in the program, coaches would need to be brought in to manage the text message delivery as well as initial enrollment of participants. As previously discussed, the development of apps that mimic the "expert systems" as reported by Nigg (2003) in his review could take the place of multiple coaches because the app could automatically detect the walking behavior and develop and deliver text messages based on the self-efficacy theory.

## Conclusion

With the continued technology movement, utilizing the described technologies and self-efficacy theory may be an excellent option for encouraging and sustaining

adequate walking for exercise levels in worksite employee populations. The *Self-Efficacy and Smartphone Model* illustrates how self-efficacy-based messages can be combined with smartphone technology to create a program suitable for the worksite population. While adherence to WWPs have been traditionally low, utilizing newly available technology such as social media and smartphone apps could increase the success of health promotion programs, thus increasing participation and adherence rates while reducing administrative costs. By using social media and smartphone apps to deliver supportive messages based on Bandura's self-efficacy theory, health educators, wellness coaches and other health professionals have an opportunity to create a virtual exercise community, linking employees through technology and building collective efficacy around sustaining adequate walking for exercise levels.

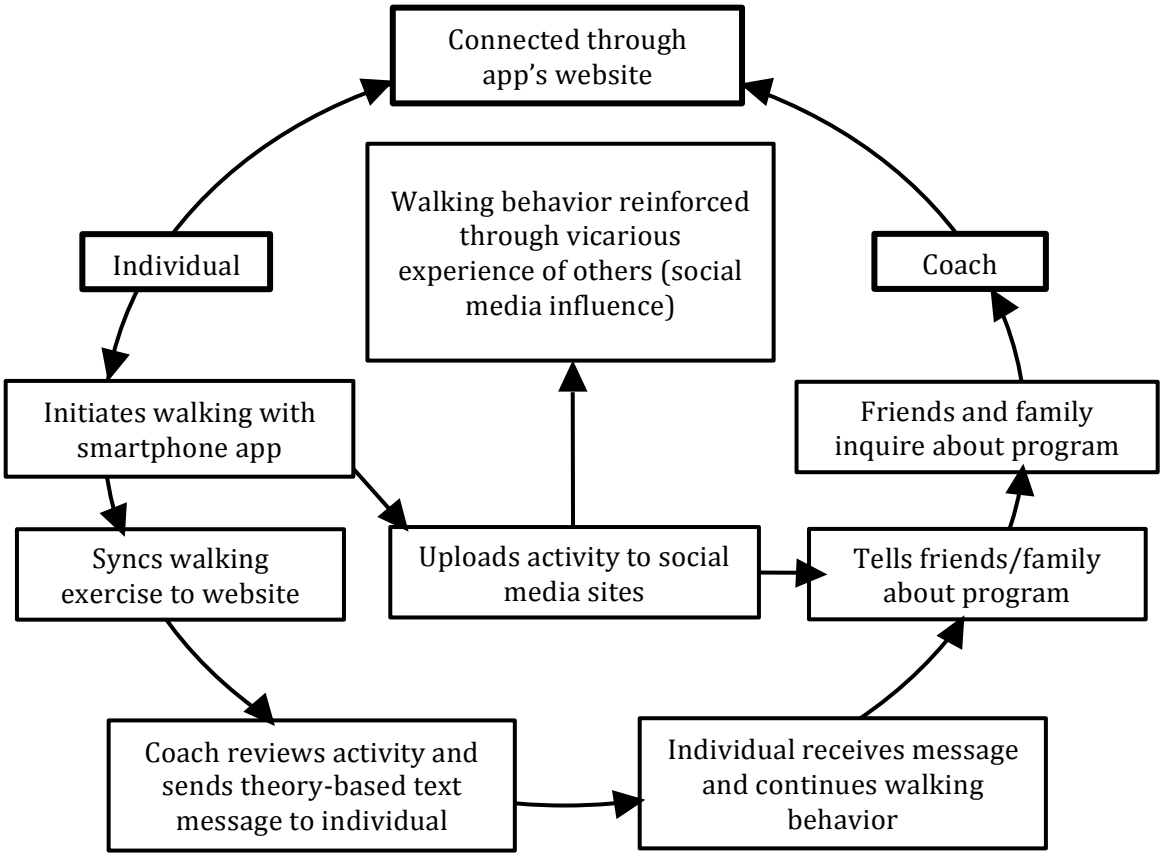


Figure 2.1. Self-Efficacy and Smartphone Model: The effect of self-efficacy-based messages, social media and a smartphone app upon walking behavior.

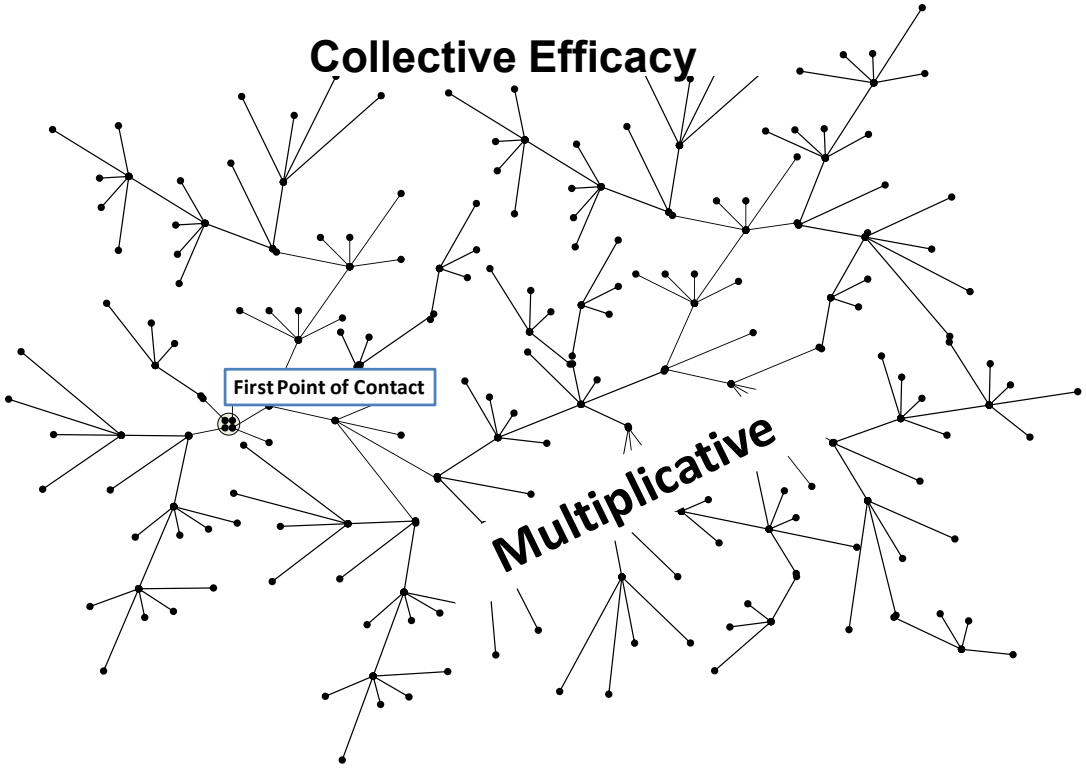


Figure 2.2 The multiplicative effect of collective efficacy when coupled with social media and word-of-mouth.

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# CHAPTER 3

# EFFECTIVENESS OF SELF-EFFICACY THEORY BASED MESSAGES DELIVERED TO FEMALE HEALTHCARE WORKERS DURING A 1-MILE WALK

FOR SUBMISSION TO *HEALTH PROMOTION PRACTICE*

# EFFETIVENESS OF SELF-EFFICACY THEORY BASED MESSAGES DELIVERED TO FEMALE HEALTHCARE WORKERS DURING A 1-MILE WALK

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Keywords: worksite health promotion, self-efficacy theory, messages, health behavior change, pilot-study, walking

## Abstract

**Objective:** Forty-three percent of U.S. adults do not get the recommended amount of physical activity prompting the National Prevention Council to develop a strategy to increase physical activity by 10% in the next 10 years. Because walking is a form of exercise that most anyone can do, this pilot study seeks to incorporate Albert Bandura's highly predictable self-efficacy theory into an intervention designed to increase beliefs in walking for exercise. **Methods:** Sixteen females between the ages of 35 and 64 from a health care organization participated in a one-group, mixed-methods, pre-post nonexperimental design study consisting of theory-based messages delivered during a 1-mile walk. Changes in self-efficacy beliefs were analyzed using a paired t-test and directed content analysis of structured interviews. **Results:** Self-efficacy beliefs increased significantly and changes in confidence as well as intentions to continue walking were evidenced in the structured interviews. **Conclusion:** Based upon the findings, there is a need to build future studies upon a solid theoretical framework, investigate innovative ways to deliver self-efficacy messages and sustain the walking for exercise behavior in a worksite population.


## Introduction/Background

The benefits of regular physical activity have been repeatedly cited in research (Bize, Johnson, & Plotnikoff, 2007; Conn, Hafdahl, Cooper, Brown, & Lusk, 2009; Teychenne, Ball, & Salmon, 2008). A meta-analysis of literature found an association between physical activity levels and health-related quality of life (Bize et al., 2007) and other studies have linked physical activity with the reduction of the likeliness of depression (Teychenne et al., 2008). Improved health can also positively affect

workplace attendance, decrease job stress, reduce risk of diabetes and increase physical fitness (Conn et al., 2009). Focusing on wellness in the worksite brings additional benefits to employers such as increased productivity, reduced medical claims, and employee turnover (Lechner & De Vries, 1995; Stoffelmayr et al., 1992; Webber & Mercure, 2010). Employees partaking in a worksite wellness program (WWP) may also encourage their families to focus upon their own health and wellness leading to improved community health.

While evidence is clear that physical activity is beneficial to health and wellness, HealthyPeople 2020 reports that only 43.5% of adults meet the established physical activity guidelines of performing between 150 to 300 minutes of moderate-intensity activity each week (U.S. Department of Health and Human Services, 2008) and that 36.2% of adults engage in no leisure-time physical activity (HealthyPeople.gov, 2011). Increasing these percentages is a focus of the National Prevention Strategy, which was created following the passage of the Affordable Care Act. This Strategy outlines key partners and strategies concentrated on improving the health of U.S. adults, decreasing health care costs and increasing health care access (National Prevention Council, 2011).

Walking

Walking is a form of physical activity that has been incorporated into WWPs for many years. Walking requires no special skills or equipment, can be performed almost anytime, anywhere and poses low risk to most populations (Murphy, Murtagh, Boreham, Hare, & Nevill, 2006; Williams, Matthews, Rutt, Napolitano, & Marcus, 2008). Hamer and Chida (2008) conducted a meta-analysis of cohort studies and found that there is an inverse relationship between walking and cardiovascular disease as well as the fact that

walking is linked with improved weight and blood pressure (Albright & Thompson, 2006) and reduced risk of heart disease and Type II diabetes (Johnson, 2005).

Haines et al. (2007) used pedometers to promote walking and wellness in a university employee setting and found significant differences in BMI, blood glucose and total cholesterol at posttest as well as moderate effects on fitness among other variables. Their study was a "virtual" walking and wellness program, utilizing computer-based program modules for education and weekly email messages sent to participants. Another university setting employee pedometer walking program study found significant improvements in 1-mile walk times and in $VO_2$ max tests (Hancher-Rauch, Hicks, & VanSickle, 2010). Similar results were found in a worksite walking program focused on reducing cardiovascular risk factors in sedentary workers Murphy et al. (2006). A significant reduction in systolic blood pressure and maintenance of body fat levels as well as improved fitness levels over the 8-week intervention period were found. In addition to these studies, research has shown that walking programs that are theory-based, particularly ones utilizing the self-efficacy construct of the social cognitive theory by Albert Bandura, have also been effective (Lee, Kuo, Fanaw, Perng, & Juang, 2012; Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005; Williams et al., 2008).

## Self-Efficacy Theory

One of the most utilized theories for behavior change is the self-efficacy theory by Albert Bandura. Self-efficacy is defined as the confidence one has in her ability to execute a given behavior and the likeliness she will persevere in the face of failure (Bandura, 1997). Sherwood and Jeffery (2000) discussed the importance of self-efficacy in relation to predicting exercise adherence, explaining that self-efficacy is the strongest

predictor of exercise behavior and that it influences the effort expended by the individual. As perceived self-efficacy increases, the likeliness to adhere to an exercise program increases. McAuley and Blissmer (2000) also highlight the effectiveness of short-bouts of physical activity to enhance self-efficacy and fostering exercise self-efficacy by coupling it with feedback.

A person's self-efficacy is actually "perceived" because it consists of their beliefs about their capability to perform a behavior. Strecher, McEvoy DeVellis, Becker, and Rosenstock describe the paradigm in this way; "behavior change and maintenance are a function of (1) expectations about the outcomes that will result from one's engaging in a behavior; and (2) expectations about one's ability to engage in or execute the behavior" (1986, p. 74). This means a person will develop "outcome expectations" as well as "efficacy expectations" and both reflect a person's belief about their capability and behavior. Self-efficacy can also vary depending on the behavior and the situation, which means a person may have high perceived self-efficacy when performing an "easy" task but their beliefs decrease as the task difficulty increases or the situation changes. Bandura (1997) describes efficacy and outcome expectations in dimensions of level, strength and generality. Level refers to the ordering of tasks by difficulty level, strength is how certain a person is in their ability to perform a specific task and generality describes to what extent the efficacy expectations can spread to other situations or behaviors.

To create behavior change, the self-efficacy theory describes four sources of information that influence a person's perceived self-efficacy: mastery experiences (past experiences), modeling (vicarious experiences), verbal persuasion and via physiological

and emotional factors (Bandura, 1997). The first is *mastery experiences,* which is also called *enactive mastery*. This source is the most effective as it allows the person to increase confidence in their ability through goal setting and practice. In the course of achievement with some failure, the person perseveres in overcoming obstacles. They recognize that past experience predicts future achievement. The second source is *vicarious learning*. Also called *social modeling*, one can increase confidence by watching another person performing the same act successfully, especially if the model is comparable in ability and likeness. As the person sees the success of the model, she is more inclined to initiate the behavior. The third source is *verbal* or *social persuasion*, which involves messages persuading a person to believe that she is capable of successfully performing the activity. Messages are specific to the person, targeted behavior and are ideally delivered at times when the person most benefits from external motivation and feedback, such as immediately prior to an event, helping persuade the person that she will be successful. In addition, messages can also be involved in increasing self-efficacy through enactive mastery and vicarious learning. The last source, *emotional arousal*, is related to a person's reaction to changes in her physical being, emotions or environmental cues. Bandura explains, "people also rely on their physical and emotional states to judge their capabilities" (2004b, p. 623). Pain, fatigue, or boredom may be read as signs of low efficacy, therefore learning to curtail or adjust to these feelings can improve one's confidence.

Verbal persuasion alone may not produce long-term increased self-efficacy, but coupling it with one or both of the other two sources can prove to be successful (Bandura, 1997). Those persons given feedback are likely to exert increased effort and persist

through difficulty because they believe they have the capabilities to be successful. An example of this useful combination of sources is allowing a person to practice a behavior, such as walking for exercise, while focusing upon development of a skill related to that behavior. According to Bandura, humans have "control" over their behavior and through goal setting, practicing the skills associated with that behavior, and self-regulation, behavior change can occur because of increased self-efficacy (Bandura, 1997). For example, an individual is given the opportunity to practice a skill (such as proper stride length) and then watches as another person similar to her ability practice as well. Coupled with specific verbal feedback from a coach, the person is more likely to continue to practice the skills of proper stride length and become increasingly resilient in the face of failure. As the person's confidence in her ability increases, it may also mediate the negative effects of emotional arousal such as stress and fatigue that come with learning a new behavior. As people learn how to read their physiological and emotional states and correct misinterpretations of these responses, their efficacy increases.

Messages

One way to operationalize this theory is through messages. Studies have found that the use of self-efficacy based messages and materials can significantly increase exercise adherence (Bock, Marcus, Pinto, & Forsyth, 2001; McAuley & Blissmer, 2000; Rovniak et al., 2005). In order to create effective messages that are truly based in self-efficacy theory, one must understand the different message elements such as *who*, *what*, *when*, *where* and *how* the message is delivered. The *who* part of the message is the person addressed and so it is important to use their name in the message. The next step is to identify the targeted behavior, such as exercise walking, and then narrow that behavior

to a particular skill, such as pacing or breathing. It is also key for the coach to identify the *when*, or during what part of the activity to deliver the message (before, during or after the activity). Next, the coach determines the order the messages are to be given and whether to use more than one source of influence (enactive mastery coupled with verbal persuasion). Lastly, the coach must consider how many and how often the messages are to be delivered based upon the targeted end result.

While successful interventions have included tailored messages (messages created based upon a person's needs or behaviors) delivered in a variety of ways (Bennett, Young, Nail, Winters-Stone, & Hanson, 2008; Bock et al., 2001; McAuley & Blissmer, 2000; Parrott, Tennant, Olejnik, & Poudevigne, 2008; Rovniak et al., 2005), few studies have clearly identified the use of high fidelity messages (messages tied closely to theoretical constructs) based on self-efficacy theory to promote behavior change. Rovniak et al. (2005) tested theoretical fidelity of an e-mail-based walking program grounded in Bandura's self-efficacy theory and found significant difference between the group who received high fidelity messages as opposed to the group receiving low fidelity or loosely-based theoretical messages. They concluded that studies closely replicating theoretical recommendations could improve behavior change interventions.

This study was initiated because of the scarcity of research using high fidelity messages based on self-efficacy theory to increase self-efficacy beliefs around walking for exercise. The study's purpose was to: (1) determine if self-efficacy theory based messages delivered during a 1-mile walk significantly increase a person's self-efficacy in their ability to walk for exercise and (2) gather administrative data including testing of

the Walking Self-Efficacy Scale Short Form instrument and self-efficacy messaging techniques. Future research can be designed based upon the results of this pilot study.

## Methods

### Design

This was a one-group, mixed methods pre-post test nonexperimental design consisting of scale data and structured interviews, approved by the University of Utah Institutional Review Board. All participants were given a written informed consent to read and sign prior to participation. Those who completed the study had their names added to a drawing for one of two $25 gift cards of their choice.

### Participants

Female participants in the age range of 35 – 64 working at least part-time at a large Academic Medical Center in the Intermountain West were recruited to participate ($n$ = 16) through fliers, email and word-of-mouth at their place of work. Participants had to be able to adequately read and speak English as well as be physically inactive, reporting exercising less than the recommended 150 minutes per week (U.S. Department of Health and Human Services, 2008). During the initial screening questions were asked of participants to determine if they were physically unable to participate in a walking program or if their health did not allow them to participate. Participants who enrolled in the study were had a mean age of 49.9 years ($SD$ = 10.2).

Measures

*Walking Self-Efficacy Scale Short Form*. The Walking Self-Efficacy Scale Short Form is a survey instrument created by the researchers to measure self-efficacy beliefs toward walking for exercise based upon Albert Bandura's Guide for Constructing Self-Efficacy Scales (Bandura, 1997; Pajares & Urdan, 2006). The survey consists of 12 questions across four activities. Participants answer the questions based on a Level of Confidence Likert scale of 0-100 with 0 being "No Confidence" and 100 being "Extremely Confident." Each of the four activities consists of three questions corresponding with gradations of difficulty ranked as easy, medium and hard for the identified task or situation. Reliability and validity had yet to be determined. Scoring of the instrument consisted of an activity score (out of 300) for each of the four activities and a total scale score (out of 1200) for both the preassessment and postassessment. An exploratory factor analysis of the scale instrument based on the principal factor method without rotation was conducted, as well as Cronbach's alpha to test the internal consistency of the scale items. Items with factor loadings that were larger than Factor 1 loadings were further analyzed and considered for removal from the analysis. The instrument can be found in Appendix A.

*One-on-one interview*. The 5-minute interview consisted of six questions regarding the participant's walking for exercise self-efficacy beliefs following the intervention and posttest Walking Self-Efficacy Scale Short Form. An example interview question is, "Do you feel differently about going for a 1-mile walk for exercise following the walk we just took"? The interview questions can be found in Appendix B.

Research Procedures

Prior to enrolling in the study, participants answered screening questions related to the inclusion criteria. Once approved, the researcher met with each participant one-on-one to complete the informed consent and a Walking Self-Efficacy Scale Short Form. Next, the researcher conducted an outdoor 1-mile walk on relatively flat terrain with the participant at their self-defined moderate intensity level. Enactive mastery and verbal persuasion self-efficacy messages built upon the self-efficacy theory (Bandura, 1997) were verbally given to the participant by the researcher during the walk. An example of a message is, "Great job, Cheryl, maintaining a steady, moderately-intense speed." After the 1-mile walk, each participant completed a second Walking Self-Efficacy Scale Short Form and then participated in a one-on-one structured interview about her walking for exercise self-efficacy beliefs. The interviews were held in a private location and recorded for transcription purposes only. Participants also had the chance to ask questions regarding the study and were encouraged to continue walking or participate in other forms of physical activity following study completion.

Analysis

A paired *t*-test was used to detect significant difference between the prescale walking for exercise beliefs and the postscale beliefs. StataCorp 12 statistical analysis software (College Station, TX) and a *p*-value of .05 was used for all analyses.

Because the structured interviews were used as confirmatory measures to quantitative data and based upon the self-efficacy theory, the directed content analysis approach (Hsieh & Shannon, 2005) was used. The a priori coding categories were

Increased Self-Efficacy and Sustainment of Walking for Exercise. Other categories were determined during coding of the transcripts.

## Results

The factor analysis of the scale (Table 3.1) showed that two question items (both for Activity 4) loaded onto Factor 2. This was considered a subscale and most likely not very reliable because it was based on only two questions and so that activity was excluded from the analysis. One question item from Activity 3 partially onto two factors but was kept in the analysis due to high internal consistency of items ($\alpha = .8764$). Using the preintervention Factor 1 loadings, each scale item was weighted, summed and then divided by the sum of the preintervention Factor 1 loadings to calculate the composite preintervention scale score and the composite postintervention scale score. Item weighting was performed due to the gradations of task difficulty for each activity corresponding to easy, medium and hard question items.

The *t*-test comparing the preintervention weighted total scale score to the postintervention weighted total scale score (Table 3.2) was significant ($t(15) = 4.21$, $p = .0007$, 2-tailed; $d = .89$), which means there was a significant difference between the preintervention and postintervention scale scores as well as a large effect (Cohen, 1988).

### Interview Results

Because the interviews were secondary measures to the quantitative date, the directed content analysis approach was used. The a priori categories were: Increased Self-Efficacy and Sustainment of Walking for Exercise and emerged categories were Increased Awareness, and Identification of Benefits and Barriers.

*Increased self-efficacy.* Many participants mentioned they now know they can "do it" (walk for exercise) as well as two said they were unsure in the beginning if they could even walk one mile. Some of comments were: "Now I know I can walk. I just felt I was out of shape I guess. I know I still am, but not as much as I thought probably, and so I was able to perform that one mile" and "previously had doubt about myself, doing any type of activities, even walking. Now I feel great after the 1 mile, I think I can pretty much can try, at least encourage myself to like, walk a mile a day".

*Sustainment of walking for exercise.* All participants stated they were confident they could repeat the 1-mile walk on their own although 1 participant mentioned motivation was a factor in determining her future participation and another commented she would be less likely to go out and walk if there was extreme weather. All but one said they plan to continue walking on their own and some stated they had formed a walking goal. For example:

> This started a goal. I was telling you about my friend at work, we just started this a month ago and it folded right in to us wanting to be more aware of exercise and our health. We've been trying to eat properly and add the exercise and so yes, I am going to continue.

*Increased awareness.* Two participants stated they were now more aware of their speed. One participant commented, "when speaking about intensity, I am probably not always walking at that intensity (1-mile walk) when I am at home or walking around my neighborhood or when I am taking the dog for a walk." The other said, "generally I told you I adjust to the dogs, but I know for me, this would be better…it could be faster."

*Identification of benefits and barriers.* Two participants talked about their increase in energy level and how good they felt after the walk: "I'll probably remember tonight how great I feel now and do it tomorrow thinking I still feel great!" and "I feel

like I've got the energy and I'm ready and so let's just keep going." One participant talked about how much her confidence had changed due to just the one time walk, "Probably my first time walking one mile. I feel like I am confident with you. I am more able to complete the 1-mile round walking. By myself I would probably stop halfway." This is echoed by another participant when asked about why she feels more confident in her ability to repeat a 1-mile on her own, she said:

> …Cause I did it. No, I didn't think could keep the pace. I have not walked at a constant pace for a really long time… Um – I was concerned because I have a bad knee and I didn't know if it would pop out or not. It hasn't, but I didn't know if the pace would cause it. I had that concern and then my age –I do not know why I am having a thing about my age. But, yeah, I felt good about it.

In addition to the concern about a bad knee and age, another participant cited not knowing where she could walk as a barrier prior to the study:

> Oh – I will continue now. Cause now I know this is going to be pretty cool now. Now that you showed me a route, I can do it before I go home, too, 'cause I didn't know where to go around here to do this kind of stuff. I really am not a gym kind of person.

## Discussion

The self-efficacy theory (as part of the social cognitive theory) is a learning theory as it not only concentrates on predicting behavior, but also teaches a person how to change their behavior (Bandura, 2004a) leading to a greater chance of sustained lifestyle change. This study sought to determine if self-efficacy messages delivered during a 1-mile walk for exercise would significantly increase walking for exercise self-efficacy beliefs. The coupling of the verbal persuasion messages with the opportunity for the participant to practice the behavior (enactive mastery) supports the self-efficacy theoretical foundations of utilizing multiple modalities to increase perceived self-efficacy

and the chances of behavior change (Hsieh & Shannon, 2005). The positive results of this study are similar to findings of Wise and Trunnell (2001) who studied the effect of combinations of sources of self-efficacy influence on women's bench-pressing weight efficacy. They found that performance accomplishment was the strongest influence in increasing bench-press efficacy, and verbal persuasion messages were most effective when following performance accomplishment.

Comments from the structured interviews highlight self-efficacy belief changes as well. All participants stated they were more confident in their ability to repeat the 1-mile walk on their own with many saying they just needed to remember how it made them feel afterwards and that it was not as hard as they thought it would be. This relates to the earlier discussion about outcome expectations. The participants may have expected the walk to be harder, but their perceived self-efficacy increased following the intervention, which changed their outcome expectations for future walking for exercise activities. The expectations at the start of a program may shape the chances of a person adhering to the program and as suggested by Desharnais, Bouillon, and Godin (1986), altering the self-efficacy and expectations early on in the program may decrease the dropout rate. With the positive changes in self-efficacy beliefs noted quantitatively as well as qualitatively, this pilot study has the potential as a starting point for changing the walking for exercise behavior of female healthcare workers.

Some participants identified their own barriers to walking (knee pain, not knowing where to walk, feeling out of shape) and recognized ways to overcome those barriers, which reflects increased self-efficacy. Two participants commented on the benefit of practicing the behavior (enactive mastery) to boost their confidence. One

mentioned that the presence of the researcher made her more confident in completing the walk (modeling). Many mentioned they knew why they should walk, which suggests that they have been educated on the benefits of regular physical activity but may need interventions to facilitate participation in the activities along with ways to increase their confidence in their ability. Again, infusing a learning theory into a worksite wellness program may produce improved and sustainable results as opposed to using a behavior predicting theory alone or no theory at all.

Although the Walking Self-Efficacy Scale needs to be modified to clearly reflect walking for exercise behavior, the internal consistency of the items was high. The two items from Activity 4 that loaded onto a second factor were not focused on walking for exercise but instead on activities beyond walking (jogging and running) and should be excluded from the instrument. This suggests that walking for exercise beliefs do not generalize to jogging and running behavior, which can be expected because self-efficacy is situation-specific (McAuley & Blissmer, 2000) and self-efficacy beliefs can differ in generality (Bandura, 1997) based upon the person's self-judgment across activities. While this instrument shows prospect for future use, it needs further development with validity and reliability measurements.

This study has several limitations. First, this was a one-group, pre-post design in which participants served as their own controls. The study could have been strengthened with use of a walking-only control group allowing for a more detailed analysis of the effect of the messages and 1-mile walk upon self-efficacy beliefs. By adding a control group though, the sample size would need to be increased to obtain a strong enough

effect signal. However, using the one-group design was reasonable because this was a pilot study.

Reliability and validity of the scale instrument was not conducted prior to the study. This posed the risk of using an instrument that may not be sensitive to the changes sought and not have strong internal consistency of items. A posthoc factor analysis confirmed that two question items did need to be removed from analysis and so further scale development should be conducted.

While significant differences in self-efficacy beliefs were revealed, further research into message development, delivery methods and approximation of time of delivery need to be conducted. Interventions and messages delivered through mail and e-mail have been most reported in literature, but alternative technological delivery methods such as through mobile devices that utilize approaches based on the self-efficacy theory could prove promising.

## Conclusion

Delivering messages based on the self-efficacy theory during a 1-mile walk for exercise significantly increased the beliefs of a worksite population composed of females between the ages of 35 and 64 on their ability to walk for exercise. Structured interview responses validated that the sources influencing self-efficacy (enactive mastery, modeling and verbal persuasion) did impact confidence as well as participant plans to continue the walking behavior. This study indicates the importance of designing future studies upon a solid theoretical framework, investigating innovative ways to deliver high fidelity self-efficacy theory-based messages and ways to sustain the walking for exercise behavior.

The potential for this population to continue walking is high, based upon these study results, but future longitudinal studies need to be conducted.

Table 3.1 Factor Analysis Walking Self-Efficacy Scale Short Form

| Activity | Question | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 |
|---|---|---|---|---|---|---|---|
| **1** | *1* | 0.7513 | -0.4803 | 0.4421 | 0.0954 | 0.0060 | -0.0286 |
| | *2* | 0.7715 | -0.0339 | -0.2220 | -0.3754 | 0.1023 | -0.0844 |
| | *3* | 0.9069 | 0.0858 | -0.3088 | -0.0899 | 0.1588 | -0.1627 |
| **2** | *4* | 0.7513 | -0.4803 | 0.4421 | 0.0954 | 0.0060 | -0.0286 |
| | *5* | 0.7944 | 0.1395 | -0.4221 | 0.2002 | -0.0381 | 0.1719 |
| | *6* | 0.8347 | 0.2106 | -0.4316 | 0.1845 | -0.0154 | 0.1243 |
| **3** | *7* | 0.6816 | -0.3927 | 0.2646 | -0.0679 | 0.2395 | 0.2709 |
| | *8* | 0.4253 | 0.5763 | 0.2712 | 0.1001 | -0.4465 | 0.1243 |
| | *9* | 0.7611 | 0.0620 | 0.0813 | -0.4468 | -0.3123 | -0.1171 |
| **4** | *10* | 0.5206 | 0.1520 | 0.0639 | 0.5391 | 0.0201 | -0.2641 |
| | *11* | 0.1286 | 0.8875 | 0.3267 | -0.0496 | 0.2288 | -0.0192 |
| | *12* | 0.1868 | 0.8861 | 0.2668 | -0.0842 | 0.1905 | 0.0369 |

Note. See Appendix A for text of numbered questions.

Table 3.2 Walking Self-Efficacy Scale Short Form Descriptive Statistics ($n$=16)

| Scale Score | Mean | *SD* | Min | Max | Max | Cohen's *d* |
|---|---|---|---|---|---|---|
| **Weighted Pretest** | 77.33 | 15.14 | 46.27 | 96.18 | 96.18 | |
| **Weighted Posttest *** | 87.57 | 9.04 | 61.96 | 97.53 | 97.53 | .89 |

Note. *$p$ < .0001, 2-tail.

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# CHAPTER 4

# THE VALUE OF SELF-EFFICACY TEXT MESSAGES AND SMARTPHONE APPS TO INCREASE THE WALKING OF WOMEN IN HEALTHCARE WORKSITES

FOR SUBMISSION TO *HEALTH EDUCTION AND BEHAVIOR*

# THE VALUE OF SELF-EFFICACY TEXT MESSAGES AND SMARTPHONE APPS TO INCREASE THE WALKING OF WOMEN IN HEALTHCARE WORKSITES

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Keywords: worksite health promotion, self-efficacy theory, messages, health behavior change, walking, smartphone, technology, text-messages

## Abstract

**Objective:** Worksite wellness programs may become more popular due to the passage of the Affordable Care Act, yet participation and adherence rates have traditionally been only at about 50%. In order to cut health care costs, improve current health and fitness and decrease the risk of disease progression, innovative ways to use new communication technologies to reach the worksite audience and sustain behavior change are explored. **Methods:** Seventy-three women from a large Academic Medical Center enrolled in a study to determine the effectiveness of a 6-week walking health promotion program utilizing a smartphone app to track their walking behavior. Text-messages derived from self-efficacy theory were sent weekly to the intervention group. Data was analyzed using factor analyses, *t*-tests, ANCOVA and multiple regression. **Results:** Self-efficacy beliefs significantly increased for both groups, but were not different between groups at posttest. Although not significant, the intervention group walked more minutes each week than the control group and sustained the behavior one extra week, but both groups dropped in minutes between weeks 5 and 6. Pulse rate significantly decreased in the intervention group as compared to control group possibly because they walked more minutes per week. **Conclusion:** There may be value in utilizing text-messages based on the self-efficacy theory plus a smartphone app to increase and sustain walking for exercise behavior as one component to a worksite wellness program but should not be used as the sole intervention.


## Introduction/Background

Following the passage of the Affordable Care Act (ACA), the National Prevention Council designed a strategy focused on preventative care, lowering health care costs and

improving quality of care and coverage for US citizens (National Prevention Council, 2011). Chronic disease health care costs are estimated to be $4.2 trillion (78% of total health spending) annually by 2023 (Bodenheimer, Chen, & Bennett, 2009). With these increasing costs and employers soon to be expected to provide insurance coverage to employees (Kaiser Family Foundation, 2010), investing in comprehensive wellness programs can save companies money as well as improve the health of employees and their families. A literature meta-analysis conducted by Baicker, Cutler, and Song (2010) found that for every dollar invested into a worksite wellness program (WWP), the company could expect an average return of $3.27 in medical costs, and absenteeism costs fall by about $2.73. Other reported benefits include increased productivity, reduced medical claims, and reduced employee turnover (Lechner & De Vries, 1995; Stoffelmayr et al., 1992; Webber & Mercure, 2010).

Although worksite health and wellness programs have seen success, participation levels are typically less than 50% (median at about 33%) and the standard adherence rate is usually no more than 50% at 3 to 6 months postenrollment (Lechner & De Vries, 1995; S. J. Robroek, F. J. van Lenthe, P. van Empelen, & A. Burdorf, 2009; Stoffelmayr et al., 1992). Few studies have been conducted on long-term behavior change following program participation, and so it has been recommended more long-term studies be conducted (Conn, Hafdahl, Cooper, Brown, & Lusk, 2009). There have been studies of determinants of WWP participation, but it is not clearly defined what is meant by "level of participation." In addition, there have been only a few studies that have focused upon adherence rates and factors, with most more than 20 years old. In one of the studies, Steinhardt and Carrier (1989) suggested that focus on attitudinal commitment is

important because while employees believe they should exercise they do not necessarily turn those beliefs into action. Another study addressed adherence to exercise through "deposit contracts" and teams, achieving a 98% adherence rate (Stoffelmayr et al., 1992). It should be noted that the adherence was based upon self-reports of exercise by the participants and not directly observed through the use of pedometers or other means. Other studies have sought to determine barriers to participating in worksite exercise programs. One study found that time/motivation, attitudes about exercise, embarrassment with exercising in fitness centers and cost in joining fitness centers were barriers (Schwetschenau, O'Brien, Cunningham, & Jex, 2008).

Some occupations, such as those in healthcare, may also be a barrier to participation. Based upon the American Time Use Survey (U.S. Department of Labor, 2008), 39% of people employed as healthcare support and 35% as practitioners worked on average, a weekend day as compared to only 31% of those in nonhealthcare occupations. Both healthcare occupations also worked longer than those in nonhealthcare on weekend days and for those employed fulltime, they were more likely to work between the hours of 10 p.m. and 5 a.m. Based upon this information, the schedules of healthcare workers can make it difficult to participate in traditional wellness programs.

A review by Flannery, Resnick, Galik, and Lipscomb (2011) describes additional self-perceived challenges of direct care workers (DCW) in participating in WWPs. Because DCWs may believe they engage in adequate amounts of physical activity due to their job responsibilities, have family and personal needs outside of work and time-dependent patient care expectations, the researchers suggest that utilizing the self-efficacy theory to focus on motivation is worth considering when designing interventions.

Walking

Walking has been identified as the most popular type of activity among adults because of its accessibility, easily controlled intensity, and is inexpensive and familiar (Ekkekakis, Backhouse, Gray, & Lind, 2008). Walking can be performed at almost any time and can easily be incorporated into daily routine such as parking the car further away from work, taking the stairs or going for a walk on breaks. It has also been suggested that there may be higher adherence to walking than more vigorous activities, making walking a choice form of physical activity (Lamb et al.; Parkkari et al. as referenced by Ekkekakis et al. (2008)).

A meta-analysis review by Abraham and Graham-Rowe (2009) found that worksites that reported walking as the targeted physical activity were more effective than those that promoted other forms of physical activity. Worksite walking interventions have predominantly used pedometers for measuring walking activity (Haines et al., 2007; Hancher-Rauch, Hicks, & VanSickle, 2010; Murphy, Murtagh, Boreham, Hare, & Nevill, 2006) with most focused on daily step-counts. Other programs have focused on education to increase walking behavior, utilizing self-report walking logs rather than monitored activity. Some studies have combined pedometer-based walking programs with e-technology (e-mails sent to participants) to try to promote walking behavior with mixed results (Aittasalo, Rinne, Pasanen, Kukkonen-Harjula, & Vasankari, 2012; Faghri et al., 2008). What appears to be missing from worksite walking programs is the use of theoretically grounded interventions. Studies have used the Transtheoretical Model (TTM) as a basis of their programs (such as the study by Faghri et al. (2008)), but this theory is not designed to be a learning-based theory. It instead places a person into a

stage of motivational readiness for change (DiClemente et al., 1991), allowing for targeted interventions for participants based upon their stage. A learning-based theory such as the social cognitive theory (SCT) by Albert Bandura, is one that helps people learn *how* to change their behavior. While there have been WWPs that used the SCT as a basis for their program, they mainly focused on education-only approaches (Amaya & Petosa, 2012; Hallam & Petosa, 2004). Worksite walking programs that specifically target walking behavior as well as incorporating ways to increase the person's confidence in their ability to execute the behavior may produce better results than seen in past WWP studies

Social Cognitive Theory and Self-Efficacy

The SCT explains the concept of human agency and its four core features: intentionality, forethought, self-reactiveness and self-reflectiveness (Bandura, 2001). Intentionality refers to plans for future action and forethought is the thoughts one has prior to initiating the action. People set goals and consider the consequences of their intended actions along with ways to produce the outcomes they want while avoiding the unfavorable ones. In addition to making plans and considerations, people also self-regulate, adopt standards, monitor their actions, self-correct and self-reward. Through self-reflectiveness, they evaluate their motivation, behavior, efficacy and thoughts against the expected outcomes, which in turn affect future behavior. Bandura states that the foundation of this human agency is efficacy beliefs, which are people's beliefs in their ability to exercise control over the environment and themselves. These beliefs influence the self-regulation of motivation and outcome expectations. The higher the self-efficacy

beliefs, the greater chance the person will build resiliency and persevere in the face of failure.

Self-efficacy is developed through four modalities: mastery experiences, social modeling or vicarious experience, verbal persuasion and physiological and emotional arousal (Bandura, 1997). The most effective influence is *mastery experience* because it is based upon one's own experience. Self-efficacy is increased through goal setting and practice, along with experiences of success but weakens with failure.

*Social modeling* is a way to increase self-efficacy beliefs by comparing one's abilities to the attainments of others; the greater the similarity to the model, the stronger the influence on self-efficacy beliefs. This is sometimes called *vicarious experience* in that the person "lives" the action through another person, using their observations as indicators for measurement of their own success.

A third source of influence is *verbal persuasion*. Self-efficacy beliefs are increased through messages built on a person's gains and only moderately beyond what they perceive they can accomplish. If they are persuaded they have the ability to successfully execute the behavior, they are more likely to persevere. Structuring the environment and activities to support success and being aware of the person's skill level and weaknesses is an important aspect of this modality.

Interpretation of *physiological* and *emotional responses* also affects a person's self-efficacy beliefs. Feeling fatigue during physical activity or fear when confronted with a phobic situation may be read as signs of low self-efficacy. Learning how to curtail these feelings and emotions is a way to increase efficacy beliefs.

Messages

Messages are one way to influence beliefs. Health behavior messages cited in research frequently utilize the foundations of the Health Belief Model (Job, 1988) and Theory of Planned Behavior (Huang, Hung, Chang, & Chang, 2009; Parrott, Tennant, Olejnik, & Poudevigne, 2008) and are typically "one-shot" public announcements such as billboards and fliers focused upon a "cue to action" through readiness, aversion, susceptibility or severity. For example, many messages are targeted as mass communication, which try to encourage a person to stop or not begin a negative behavior such as cigarette smoking. These types of messages may not be as successful for promoting positive behavior such as encouraging and sustaining physical activity because they are generalized across the targeted population (Bandura, 2002) and are focused on fear arousal (Job, 1988).

However, successful positive behavior change messages such as the use of discriminate, tailored and targeted messages have shown significant positive changes in health behavior (Huang et al., 2009; Parrott et al., 2008; Rovniak, Hovell, Wojcik, Winett, & Martinez-Donate, 2005; Wilbur et al., 2008). Other successful interventions have effectively created behavior change by coupling experiential learning with persuasion messages delivered either directly via face-to-face or telephone messages or indirectly through mail and e-mail (Bennett, Young, Nail, Winters-Stone, & Hanson, 2008; Bock, Marcus, Pinto, & Forsyth, 2001; McAuley & Blissmer, 2000; Parrott et al., 2008; Rovniak et al., 2005). A review article by Fjeldsoe, Marshall, and Miller (2009) outlined behavior change interventions that were delivered virtually through Short-Message Service (SMS) or text messages on the mobile phone. They found that all

studies used tailored messages (messages specific to the person, their behavior or needs) except two, and those two had the highest attrition rate for their programs. Thirteen of the fourteen studies had positive behavior change outcomes suggesting that the use of personally tailored text messages may affect short-term behavior change. Another study by Patrick et al. (2009) tested weight-loss strategy and reminder text-messages sent two to five times per day. The messages sent to the intervention group were generally tailored to the recipient's needs or response but were not theory-based. There was a significant difference in the weight between the two groups at the end of 4 months and participants said they would recommend the weight loss intervention to others.

In contrast to a tailored message, a message based on the self-efficacy theory is one that focuses on the *who*, *what*, *when*, *where*, and *how* the message is delivered. When crafting the message, the name of the recipient is used which helps personalize the message. Targeting the message to a particular skill or behavior is also important, constituting the "what" of the message. Next, when and where the message is delivered depends on the intended performance expectation. Messages can be delivered during practice of the behavior (mastery experience) as well as during vicarious learning experiences. In addition, to build confidence in one's ability to perform the behavior in the future, verbal persuasion messages can be delivered prior to initiation of the behavior. Very few studies have specifically targeted the use of theory-based messages to increase exercise behavior and beliefs. One study by Plotnikoff, McCargar, Wilson, and Loucaides (2005) utilized an e-mail-based WWP to increase physical activity, improved nutrition and self-efficacy beliefs. Weekly e-mails based upon social cognitive theory as well as additional theoretical constructs were sent to participants in the intervention group

for 12 weeks. The control group received no form of intervention, physical activity monitoring or contact. At posttest, self-reported physical activity levels increased for the intervention group and decreased for the control group, suggesting the theory-based e-mails may have promoted longer sustainment of physical activity. Self-efficacy beliefs also significantly increased for the intervention group. While promising results were found for future intervention development for WWPs, this study is limited because it focuses on general physical activity that is self-reported and not quantitatively measured. The authors suggest the use of pedometers for objective measurements as well as continued research on the use of e-technology messages grounded in social cognitive theory for consideration. As seen in Plotnikoff and colleagues' study, with the exponential growth of technology, being able to deliver these theory-based messages in new ways continues to grow.

Smartphone Applications

Mobile phones are evolving with capabilities such as accessing the World Wide Web, email and applications (apps) now common. These types of mobile phones are called smartphones with 61% of adults ages 16 and older owning one (The Neilson Company, 2013). Smartphones use programs called apps to perform a variety of procedures from scanning product barcodes to displaying spreadsheets and documents. Health and fitness apps have proliferated with over 10,000 apps available between the iTunes App Store and Google Android Market (U.S. Department of Health and Human Services (HHS) Text4Health Task Force, n.d.). Health care practitioners have used apps for their clinical practice and in communicating with patients (Lindeque, Franko, & Bhola, 2011; Mohan & Branford, 2012) and studies are being conducted on the feasibility

and reliability of health apps for managing disease (Årsand et al., 2012; Cafazzo, Casselman, Hamming, Katzman, & Palmert, 2012). There have been studies on the use of cell phones for physical activity-based interventions (Liu et al., 2008; Taylor & Katomeri, 2007), but minimal research has been published for the use of cell phone apps to increase and maintain the physical activity guidelines, particularly in the worksite population.

Because of the minimal research for the use of physical activity or walking apps, as well as text messages based on self-efficacy theory delivered to a healthcare worksite population, the purpose of this study was to determine if: (1) the use of a smartphone exercise app along with enactive mastery and verbal persuasion messages would promote and sustain walking for exercise significantly better than the use of the exercise app alone, (2) the use of a smartphone exercise app and self-efficacy messages increases the likeliness to participate in physical activity beyond walking and (3) the intervention group will have higher mean walking minutes than the control group at the 6-week post test. It is hypothesized that the intervention group will have significantly higher self-efficacy walking for exercise beliefs postintervention as well as significantly higher mean weekly walking minutes than the control group.

## Methods

### Design

This was a two-group (2x2) randomized control true experimental single-blinded study design in which the study participants were blinded to their randomized group. The University of Utah Institutional Review Board approved the study and all participants were given a written informed consent to read and sign prior to participation. Those who

completed the study had their names added to a drawing for one of five $50 gift-cards of their choice as well as all receiving a pair of athletic-style elastic shoelaces.

Participants

Female participants working at least part-time at a large Academic Medical Center in the Intermountain West were recruited to participate ($n$ = 73) through fliers, email and word-of-mouth at their place of work. The participants were randomly assigned using a random number assignment technique with 36 women in experimental group and 37 women in control group. At posttest, there were 33 women in the control group and 30 in the intervention group for a 92.7% adherence rate. Ten women withdrew from the study and were contacted to determine reasons for withdrawal as well as to solicit feedback for future study design. The mean age of the sample was 46.5 years ($SD$ = 7.6), and the mean self-reported moderate-intensity exercise minutes-per-week at baseline were 37.6 ($SD$ = 38.0, range 0–140). Participants had to be able to adequately read and speak English and be physically inactive, reporting exercising less than the recommended 150 minutes per week. They also had to own a compatible smartphone and agree to carry it with them each time they walked for exercise. Following initial screening questions as well as completion of the Physical Activity Readiness Questionnaire (PAR-Q), participants were excluded from the study if they were physically unable to participate in a walking program or if their health did not allow them to participate. The PAR-Q is a standardized, published screening form to help determine if a physician should be consulted prior to beginning an exercise program (Canada's Physical Activity Guide to Healthy Active Living, Health Canada, 1998). If the participant answered “yes” to any question, the reasons were discussed and if a doctor

needed to be consulted, the recommendation was made prior to enrollment. The instrument can be found in Appendix C.

Measures

*Walking Self-Efficacy Scale.* The Walking Self-Efficacy Scale is an instrument created by the researchers to measure self-efficacy beliefs around walking for exercise, based upon Albert Bandura's Guide for Constructing Self-Efficacy Scales (Bandura, 1997; Pajares & Urdan, 2006). This instrument consists of 21 questions divided into seven activities. Participants answer the questions based on a Level of Confidence Likert scale of 0–100 with 0 being "No Confidence" and 100 being "Extremely Confident." Each of the seven activities consists of three questions corresponding with gradations of difficulty ranked as easy, medium and hard for the identified task or situation. Reliability and validity have yet to be conducted. Scoring consisted of an activity score (out of 300) for each of the seven activities as well as a total instrument score (out of 2100) for both the preassessment and postassessment. An exploratory factor analysis of the scale based on the principal factor method without rotation was conducted as well as Cronbach's alpha to test the internal consistency of the survey items ($\alpha = .9524$). Factor loadings for each item that were larger than Factor 1 were further analyzed and considered for removal from the analysis. The instrument can be found in Appendix D.

*Walking distance and duration logs.* These logs were collected by the smartphone exercise app (using the accelerometer feature of the smartphone) each time a walking for exercise activity was initiated and then the data were uploaded to the secure website. The logs include walking duration, frequency, distance covered while walking and elevation changes. Reliability and validity of the actual app has not been completed,

but there has been high reliability (ICC = .95) between two accelerometer-based smartphones used to assess physical activity (Saha et al., 2010).

*Physical Activity Generalizability Questionnaire.* A three-question questionnaire created by the researchers to evaluate the participant's beliefs regarding how likely she is to initiate an activity beyond walking. It consists of a Likert scale of 0–100 with 0 being "Not Very Likely" to 100 being "Very Likely." Reliability and validity have yet to be recorded. Scoring consisted of a total score out of 300. An exploratory factor analysis of the scale based on the principal factor method without rotation was conducted. The instrument can be found in Appendix E.

*Biometrics.* During the pretest and posttest, each participant had her weight, resting pulse rate and systolic blood pressure manually taken and recorded. The women also self-reported their height for purposes of calculating BMI.

## Research Procedures

Prior to enrolling in the study, participants answered screening questions related to the inclusion criteria. Participants were randomized through a random number assignment into either the control ($n$ = 35) or intervention group ($n$ = 38) and encouraged to download the free smartphone app, Adidas miCoach, prior to the first meeting. Each participant met one-on-one with the researcher to complete the consent form, the PAR-Q, a Walking Self-Efficacy Scale, and to collect weight, height, resting heart rate, and blood pressure measurements. Participants were advised they may receive a text message once a week and each agreed to give the researcher their mobile phone numbers. They were then assigned a unique ID for registration of their app under the study account. After a brief orientation to the app, participants were educated on how to use a Rating of

Perceived Exertion (RPE) scale to judge their intensity levels. The scale used ranged from 0 (nothing at all) to 10 (very, very hard) with 3 designated as "moderate." Participants were then oriented to the 12-minute fitness test delivered through the app used to calibrate the app to the individual's fitness level. This test walked the participant through the RPE scale starting at light walking through level 9 (sub-max level). Each interval lasted between 30 seconds and 2 minutes and participants were encouraged to pace themselves over the testing period in order to reach level 9 at the appropriate time.

In order to get the most accurate data through the smartphone's GPS utility, participants were encouraged to walk outdoors. If a treadmill was used, participants were reminded to turn on the app at the start of their walk and then record the time and distance walked in the app when finished.

Once the participant completed the 12-minute fitness test, she was instructed on how to upload her walks to the app website viewable only by the researcher. A how-to document and trouble-shooting guide along with a basic walking plan was reviewed with each participant and handouts given. Participants were advised they did not have to follow the walking plan but that it may be a good place to start to help them reach the recommended 150 minutes of walking a week by the end of the study. They were instructed to walk at a moderate intensity level for a minimum of 10 minutes at a time as many days of the week as possible, aiming for at least 30 minutes walking per day. Education on proper walking techniques, athletic shoe fitting, and basic stretches was also given along with handouts. The participants had the chance to ask questions regarding the study and were encouraged to contact the researcher with any questions,

injuries sustained or feedback. The total enrollment meeting time was approximately 1.25 hours.

Intervention

Participants began their own self-directed walking program aiming to work up to the 150 minutes or more of walking at a moderate intensity a week by the last week of the study. Those participants randomized to the intervention group received text messages from the researcher once a week on Saturday. The messages were individually tailored based upon the participant's walking logs for the previous week(s). An example of a message is, "Holly, your overall pacing is steadily increasing," and "Stacey, great pacing on your walk."

At the 6-week, 45-minute follow-up appointment, the same biometric measures from the pretest were obtained, the Walking Self-Efficacy Scale was completed and also a Physical Activity Generalizability Scale. The Physical Activity Generalizability Scale was only conducted at the posttest. The 12-minute fitness test was repeated and the participant reported any missed walks not uploaded to the website. Participants were asked how the study went and any feedback for future study design. The study ID was removed from each person's smartphone and participants were assisted in setting up the app with their own account if desired. The app's website was also reviewed with each participant. Everyone was encouraged to continue walking or participate in other forms of physical activity after finishing the study.

Analysis

To test for homogeneity of the two groups at baseline, *t*-tests were completed. Descriptive statistics and paired *t*-tests of variables for pre- versus posttest results were also conducted (Table 4.1). Walking Self-Efficacy Scale items were weighted using the pretest factor analysis Factor 1 loadings for each scale question. A total composite weighted pretest score and posttest score were calculated for each group by summing the weighted questions and then dividing by the sum of the pretest Factor 1 loadings.

Analysis of Covariance (ANCOVA) and paired *t*-tests were conducted to analyze the change in self-efficacy beliefs and ANCOVA's for the likeliness to perform physical activity outside of walking. Mean minutes walked each week by group were calculated and analyzed using cross time regression and ANCOVA models. Regression models were run to determine which independent variables might predict self-efficacy beliefs and mean walking minutes. StataCorp 12 statistical analysis software (College Station, TX) and a *p*-value of .05 was used for all analyses.

## Results

There was no statistically significant difference between the two groups at baseline. The factor analysis of the Walking Self-Efficacy Scale showed that two question items (both for Activity 7 which were focused on jogging and running) loaded onto Factor 2. This loading was considered a subscale and most likely not very reliable because it was based on only two questions and so that activity was excluded from the analysis. Cronbach's alpha of .9524 confirmed the scale instrument without Activity 7 had high internal consistency of items. There was also no significant difference between

groups for the Physical Activity Generalizability Survey and so further scale analysis was not conducted.

While the groups were not different from each other at baseline, the self-reported baseline activity level variable was marginally significant when analyzed with the self-efficacy scale scores ($\beta = -.059$, $p = .068$, 2-tail) and with the total minutes walked over the 6 weeks ($\beta = 2.27$, $p = .053$, 2-tail) and so was treated as a confounder in all analyses.

Change in self-efficacy beliefs were analyzed using within-group paired *t*-tests. The intervention group ($t(29) = -2.30$, $p = .0003$, 2-tail; $d = .42$) and control group ($t(32) = -4.07$, $p = .0288$, 2-tail; $d = .71$) both had significant changes in self-efficacy beliefs as well as medium effect sizes (Cohen, 1988). An ANCOVA determined that there was no difference in self-efficacy beliefs between groups at posttest.

Cross-time regression analyses with an interaction term of group x weeks found that there was a difference between groups in their minutes walked over the weeks ($\beta = 5.62$, $p < .0325$, 1-tail) with the control group decreasing in mean minutes walked each week faster than the experimental group and so post-hoc secondary regression analyses and a profile plot (Figure 4.1) were generated to determine within which weeks there was a difference. After controlling for baseline exercise, the intervention group walked more minutes each week than the control group but a significant difference was found only at weeks five ($\beta = 35.94$, $p = .06$, 2-tail) and six ($\beta = 38.21$, $p = .03$, 2-tail). Further cross-time regression analysis found that the intervention group walked 3 minutes less each week from weeks 1 to 6 but was not statistically significant ($p = .135$) while the control group walked 8 minutes less each week and was statistically significant ($p < .000$). It is worth noting that the difference in mean walking minutes for the intervention group

between week 1 and week 6 was -20.8 minutes (not statistically significant at $p = .099$, 2-tail) while the difference between week 1 and week 6 for the control group was -50.3 minutes ($p < .001$), dropping almost half from week one and quickly approaching baseline (Table 4.2).

Regression analysis was conducted to determine which independent variables might predict higher self-efficacy beliefs related to walking for exercise and total walking minutes. BMI was the only independent variable that affects self-efficacy beliefs ($p = .007$, 2-tail) with the self-efficacy beliefs decreasing by .52 units for every 1-unit increase in BMI. There was no difference between groups when stratifying by obese (BMI > 30) versus not obese. Two independent variables, self-reported baseline exercise activity minutes ($p = .029$, 2-tail) and age ($p = .017$, 2-tail), affect the total walking minutes. For every minute, on average, that a person reported they exercised at baseline, they walked 2.47 more minutes over the 6 weeks; and for every year increase in age, the person walked 13.51 more minutes.

Paired *t*-tests for differences in pre- and posttests of variables for each group were analyzed and can be viewed in Table 4.1. The pulse rate decreased for the intervention group ($t(29) = 3.14$, $p = .0038$, 2-tail; $d = .57$) with no changes in independent variables for the control group.

Over the 6 weeks, 10 women withdrew from the study. Reasons included unrelated injuries, chronic pain or illness occurring during the study (70%), work schedules not allowing for time to walk or getting sweaty when walking on breaks (20%), home-related factors (10%), motivation to radically adjust current schedule to include walking (10%) and cell phone issues (10%). Although these participants withdrew from

the study, they remarked that they enjoyed being able to see what they had accomplished right away with the smartphone app as well as knowing someone could see their activity, helping them be "more accountable." All stated the enrollment process was easy, directions given to the location were well written and scheduling was convenient. Many said they planned to continue to use the app.

In addition to those who withdrew, participants who completed the study were also asked for feedback on the program as well as if they would like to continue to use the app following the study. Participants in both groups commented that the study was motivating and their family members had been walking with them as well. Many mentioned how much better they were feeling and the study was enjoyable. One participant commented that the walking "helped me unwind from the day and helped with the stress" and another said, "I walked the furthest on the days I worked thirteen hours and was really stressed."

Multiple participants said they felt stronger, lost weight or their clothes were fitting better. One participant said, "I know I gained weight but my clothes are looser and people have told me my clothes are looser too!" Others said they got to where they needed the walking and began noticing the amount of sitting they did in relation to walking. Several intervention group participants mentioned the helpfulness of the texts. One said, "Your texts really helped! Thank you!" and another said, "Your messages really helped me. It made it so much easier when you told me I could just walk for ten minutes at a time. That is what helped me stay with it." In addition to the positive response, all but one person chose to continue using the app.

## Discussion

This study sought to determine if the combination of a smartphone app plus text messages based on self-efficacy theory would increase walking for exercise beliefs and mean weekly walking minutes in a female healthcare worksite population. Both groups did have a significant difference between their pretest beliefs as compared to their posttest beliefs, but there was no significant difference between groups at posttest. There may be a few reasons why self-efficacy beliefs were not different between groups at posttest. First, beliefs were measured only at pretest and at the 6-week posttest. Beliefs may have changed significantly between groups during weeks 1 – 5 but were not detected due to only two measurements taken. Both groups used a smartphone app to monitor their walking for exercise behavior and so it is possible that the self-efficacy text messages were not enough to significantly increase beliefs beyond that of the behavior self-monitoring and the act of practicing the behavior (mastery experience). In addition, the self-efficacy messages were delivered only once a week. Bandura suggests that messages delivered just before or during the behavior highly influence self-efficacy and so the messages provided once a week may have been insufficient to significantly influence beliefs beyond that of the effect of mastery experience (Bandura, 1997). Ways this could potentially occur include apps designed to detect behavior and deliver messages during or right after the activity as well as timed apps in which a message is delivered at certain times of the day as specified by the recipient or coach. More research needs to be conducted on the ideal frequency and timing of message delivery as well as the point of saturation in which the text-messages stop producing an effect. Additional focus on the frequency of personal contact (by phone or face-to-face) between a coach

and participant to supplement the text-messages is also warranted because determining the frequency of personal contact may be an important aspect to program success.

There was a difference in self-efficacy beliefs effect sizes for the two groups with the control group achieving a higher effect size over the intervention group. Possible reasons include that the intervention group (while not significant) did start out with higher mean self-reported baseline exercise minutes as well as pretest self-efficacy beliefs than the control group. Because the intervention group could be considered "exercisers" over the control group, they would possibly score their walking self-efficacy beliefs higher. In addition, because the self-efficacy scale ends at 100, the intervention group's beliefs could raise only so much (possible ceiling effect) and so less chance of change from pre to posttest, while the control group had more room to climb.

Although there was no significant difference between groups for self-efficacy beliefs, the intervention grouped walked more minutes each week than the control group with a significant difference at weeks 5 and 6. The intervention group also sustained their walking behavior an extra week (through week 5) beyond the control group, which suggests that the self-efficacy text-messages may have sustained the behavior longer than in the control group as similarly seen in the study by Plotnikoff et al. (2005). There was also a significant decrease in mean walking minutes between week 1 and week 6 for the control group and not significantly different for the intervention which was confirmed through the cross-time regression analysis. This suggests that while both groups decreased in mean walking minutes in weeks 5 and 6, the self-efficacy text messages had an effect upon the intervention group sustaining their behavior. Although neither group

returned to their self-reported baseline average exercise minutes, the study ceased data collection before this may have occurred.

The cause of the drop in both groups between weeks 5 and 6 is unknown. Some reasons may be the posttests were held October – early December, which are colder months in Utah with frequent smog/inversion activity, decreasing the amount of time the participants may have chosen to walk outdoors. It was flu season, as well as the Thanksgiving holiday and academic semester Fall Break occurred during the posttests, which may have also affected the walking behavior. There is the possibility the participants started performing other types of physical activities such as aerobics, swimming or other indoor activities in place of the walking.

BMI was the only independent variable that predicted self-efficacy beliefs, which may be due to the participant's negative perception of her weight or body image decreasing her confidence in her ability to walk in a variety of situations. Similarly, a study by McAuley (1992) found an inverse relationship between body composition and self-efficacy at baseline. In addition, with increased weight, there may be the feeling of fatigue or pain when performing physical activity, which relates to the emotional arousal and physiological factors previously discussed, decreasing one's self-efficacy. Bandura cautions the use of predictor variables with regards to self-efficacy beliefs because beliefs are related to a variety of variables and so each situation can produce a different effect (Bandura, 1997).

The two independent variables that predicted total walking minutes were baseline average exercise minutes and participant age. It makes sense that the more active a person is at baseline, the likeliness she will be active during the study. Walking is a

choice form of exercise for older adults as well as for women (Hovell et al., 1989) which supports why age was correlated with increased number of minutes walked. This may be because the older the woman, the less likely she has children at home to tend and thus more time to devote to walking. Also, younger women may be students in addition to working which may decrease the time they give to walking. There is also the possibility the younger women performed other physical activity outside of walking and the older women chose to walk over other activities.

Based upon the analysis, the Walking Self-Efficacy Scale needs further development, including additional reliability and validity studies. For the two items that loaded onto a second factor, these items related to jogging and running are not related to walking and should therefore be excluded. This finding plus the fact that the Physical Activity Generalizability survey did not show statistical differences between groups suggests that walking self-efficacy beliefs did not translate to other activities beyond walking which can be expected because self-efficacy is situation-specific (McAuley & Blissmer, 2000) and self-efficacy beliefs can differ in generality (Bandura, 1997) based upon the person's self-judgment across activities.

This study has several limitations. First, the sample size was small and so easier than a larger sample size to be affected by confounders and other factors. The participants were blinded to their group enrollment, but some of them had friends in the study and so there was the chance of diffusion or imitation treatment bias. Third, while a control group was utilized, this group did receive a form of an intervention (use of the smartphone app to monitor their behavior) and so using the app may have influenced their walking behavior. A wait-listed control group would have been useful to this study

to clearly determine the effect of the self-efficacy messages and smartphone app. The length of the study was short, but the sharp drop at week 5 suggests that extending the study another few weeks may not have given any more useful information. Lastly, the study had rolling enrollment and so the time of year and weather were not controlled and may have been a confounder when interpreting the results.

## Conclusion

This study was focused on determining the value of self-efficacy theory messages delivered as text messages in addition to the use of a smartphone app to track walking for exercise behavior. While self-efficacy beliefs were not different between groups at posttest and the walking behavior was not sustained, it was noted that those in the intervention group walked an extra week longer than the control group before dropping off. The intervention group also walked more mean minutes than the control group each week.

While there is value in utilizing a smartphone app to track walking for exercise behavior and using text-messages as a delivery method for self-efficacy theory based messages, it is not recommended as a single modality to sustain walking for exercise behavior in a female healthcare worksite population. Research has suggested that WWPs be multi-faceted (Robroek, Van Lenthe, Van Empelen, & Burdorf, 2009) to meet the needs of the large population, and so using text-messages combined with the self-efficacy theory could be a part of a successful program. It is also important that further research be conducted to determine the adequate number of theory-based text messages to be delivered as well as appropriate delivery times to affect self-efficacy beliefs about walking for exercise. In addition, there should be further research on the frequency of

personal contact (versus virtual) as saturation levels of text messages may occur leading to decreased participant interest and walking behavior.

With caution, it is suggested that researchers consider the use of smartphone apps and text-messages grounded in self-efficacy theory as part of a comprehensive WWP. While the text messages did not sustain behavior change, they did sustain the walking behavior longer than without text messages.

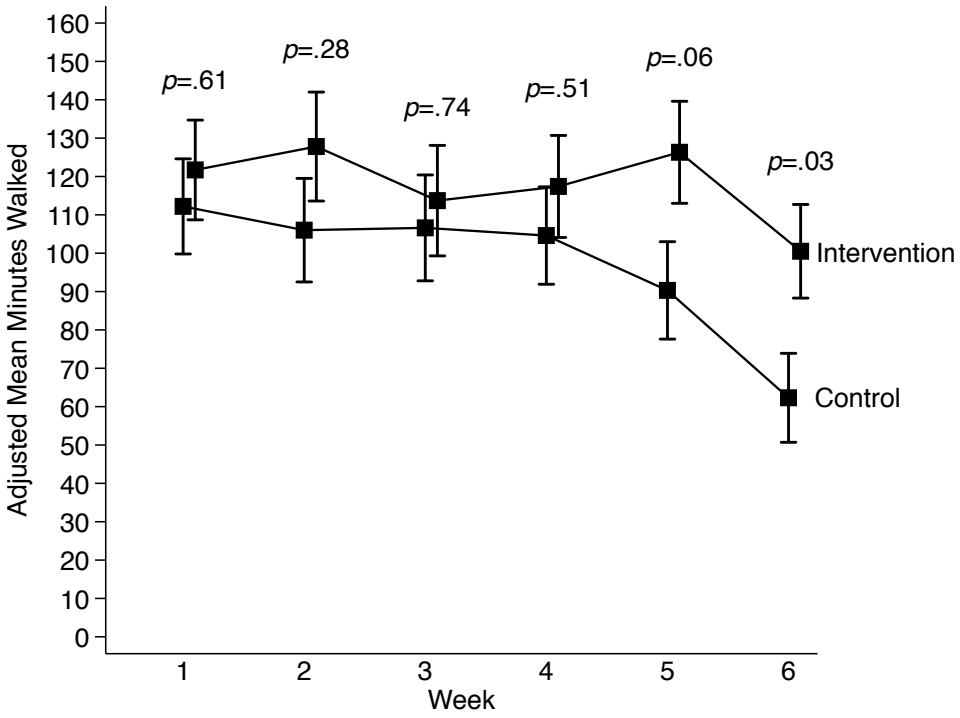


Figure 4.1 Profile plot of weekly mean minutes walked adjusted for baseline exercise

Table 4.1 Descriptive Statistics of Variables

| Variable | Group | Mean | *SD* | Min | Max | Cohen's *d* |
|---|---|---|---|---|---|---|
| **Self-efficacy Beliefs** | | | | | | |
| Pretest | Intervention | 85.6 | 12.1 | 56.6 | 100 | - |
| | Control | 78.3 | 14.7 | 38.0 | 100 | - |
| Posttest | Intervention*** | 90.0 | 10.8 | 55.7 | 99.5 | .42 |
| | Control** | 87.3 | 11.6 | 61.7 | 100 | .71 |
| **Weight** | | | | | | |
| Pretest | Intervention | 184.9 | 44.4 | 97.4 | 325.4 | - |
| | Control | 186.2 | 46.9 | 116.2 | 356.0 | - |
| Posttest | Intervention | 184.9 | 43.3 | 102.0 | 326.8 | .01 |
| | Control | 186.9 | 46.8 | 115.0 | 350.8 | .19 |
| **BMI** | | | | | | |
| Pretest | Intervention | 30.5 | 7.7 | 17.8 | 49.5 | - |
| | Control | 31.0 | 7.0 | 21.3 | 52.6 | - |
| Posttest | Intervention | 30.4 | 7.5 | 18.7 | 49.7 | .02 |
| | Control | 31.2 | 7.0 | 21.0 | 51.8 | .26 |
| **Systolic BP** | | | | | | |
| Pretest | Intervention | 119.9 | 15.6 | 88.0 | 148.0 | - |
| | Control | 117.4 | 11.2 | 92.0 | 138.0 | - |
| Posttest | Intervention | 118.1 | 14.5 | 96.0 | 150.0 | .18 |
| | Control | 118.7 | 12.9 | 88.0 | 142.0 | .14 |
| **Pulse Rate** | | | | | | |
| Pretest | Intervention | 70.0 | 11.0 | 48.0 | 100.0 | - |
| | Control | 71.1 | 11.2 | 48.0 | 100.0 | - |
| Posttest | Intervention** | 63.2 | 10.2 | 44.0 | 88.0 | .57 |
| | Control | 68.5 | 10.8 | 48.0 | 100.0 | .25 |

Note. * = $p < .001$, 2-tail; ** = $p < .01$, 2-tail; *** = $p < .05$, 2-tail

Table 4.2 Weekly Adjusted Mean Minutes Walked

| | | Week | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Group | Avg Ex | 1 | 2 | 3 | 4 | 5 | 6 | Difference Wk1/Wk6 |
| Control | 31.8 | 112.2 | 106.0 | 106.6 | 104.6 | 90.3 | 62.3 | -50.3 |
| Intervention | 43.9 | 121.7 | 127.8 | 113.7 | 117.4 | 126.3 | 100.5 | -20.8 |

Note. Avg E is the baseline self-reported average minutes per week of moderate intensity exercise

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# CHAPTER 5

# SUMMARY AND CONCLUSIONS

## Summary

Because health care costs related to chronic disease are already estimated to be $4.2 trillion annually by 2023 (Bodenheimer, Chen, & Bennett, 2009), investing in comprehensive wellness programs can save employers money as well as improve the health of the worksite population. While some programs have proven successful, participation levels are typically less than 50% and at 3 to 6 months postenrollment only half of those enrolled are still participating (Lechner & De Vries, 1995; Robroek, Van Lenthe, Van Empelen, & Burdorf, 2009; Stoffelmayr et al., 1992). Research is still needed to determine interventions that promote participation as well as sustain behavior change postenrollment for employees who are physically inactive or have high risk factors for cardiovascular disease, diabetes and other chronic illnesses.

One component of comprehensive WWPs is increasing or sustaining physical activity behavior. While there are many forms of physical activity, consideration should be given to activities that are lifestyle-based. These are activities that are easily adapted into everyday life such as walking. Walking is accessible to most people, requires no special skills or equipment, can be performed almost anytime, anywhere and poses low risk to most populations (Murphy, Murtagh, Boreham, Hare, & Nevill, 2006; Williams, Matthews, Rutt, Napolitano, & Marcus, 2008). All subgroups surveyed in the 2010 National Health Interview Survey reported significant increase in walking from 55.7% in 2005 to 62.0% suggesting walking continues to be a popular mode of physical activity for U.S. adults.

The self-efficacy theory as detailed by Albert Bandura (1997), addresses some of the root issues of motivation and effort affecting behavioral change. The theory explains

there are four sources of influence on a person's self-efficacy: mastery experiences or enactive mastery, vicarious experience, verbal persuasion and emotional and physiological factors. These sources can be operationalized through practice as well as through targeted messages delivered to the recipient face-to-face, through written correspondence or virtually.

Social media (such as Facebook, Twitter, etc.) and smartphones that utilize health and fitness applications are innovative technologies available to deliver self-efficacy messages based on Bandura's self-efficacy theory. These technologies can tap into the social aspects that support behavior change, thereby increasing individual and collective efficacy. Because of this potential, it is worth exploring technology's value in the design of health promotion interventions for worksite health and wellness programs, particularly in promoting and sustaining walking for exercise behavior.

## Outcomes of Research

Following a description and purpose of the researcher-developed *Self-Efficacy* and *Smartphone Model*, application of the model was initiated in two studies. These studies focused on the use of the self-efficacy theory by Albert Bandura to deliver theory-based messages to a female healthcare worksite population with hopes of increasing and sustaining self-efficacy beliefs about walking for exercise and sustaining walking behavior. The two studies were: (1) a pilot study focused on the creation and delivery of the theory-based messages during a 1-mile walk for exercise and (2) a sustainability study determining if self-efficacy messages could be provided through alternative means (using text messages delivered via a mobile phone) over 6-weeks, achieving the same effect as the pilot study plus sustained walking for exercise behavior.

Results from the pilot study confirmed that messages based upon the self-efficacy theory delivered during the 1-mile walk positively influenced the participant's beliefs in their ability to walk for exercise as evidenced through the use of a scale instrument and structured interviews. There was a significant increase in walking for exercise self-efficacy beliefs between pre- and posttest, which was confirmed with interview responses.

The sustainability study found that there is value in the use of a smartphone app to track walking for exercise behavior as well as value in weekly delivered text messages based upon the self-efficacy theory to sustain short-term walking for exercise behavior. Both groups significantly increased their self-efficacy beliefs between pre- and posttest but it is unclear if that was due to the use of the smartphone app or a confounder, as there was not a true control group utilized. Although self-efficacy beliefs significantly increased, there was not a significant difference between groups at posttest.

In addition to beliefs, walking behavior increased from baseline for both groups during the 6-week study with the intervention group walking more minutes each week than the control group. While both groups dropped in mean walking minutes between weeks 5 and 6, the intervention group walked 1 extra week more than the control group before dropping which could be attributed to the use of the text messages. It was expected that the self-efficacy messages would increase as well as sustain walking for exercise behavior for long-term results, but based upon the study, they only provided short-term sustainment of behavior.

While the randomized true experimental design essentially controlled for threats to internal validity, there was the chance for diffusion or treatment bias due to friends

enrolling into the Sustainability study. In addition, the rolling enrollment of participants may have allowed for seasonality to confound the results. Thanksgiving, Fall Break, poor weather and inversions may have affected participant walking behavior.

## Recommendations

These studies laid a respectable foundation for future research around the development of theory-based self-efficacy messages as well as alternative means for message delivery in a healthcare worksite population. The smartphone app was well received and may be an additional way to track walking for exercise behavior beyond archaic written walking logs.

During the sustainability study, both the control group and intervention group utilized a smartphone app to track their walking for exercise behavior and so it is difficult to distinguish the treatment effect of the smartphone app upon their behavior or beliefs as opposed to a group who did not use a smartphone app. Future studies should employ a true wait-listed control group to clearly determine the effects of the messages.

Another suggestion is to focus upon the delivery time and frequency of the self-efficacy messages. During the pilot study the messages were delivered face-to-face before, during and after the 1-mile walk, which utilized mastery experience as well as verbal persuasion sources of influence to increase the participant's self-efficacy. For the sustainability study, the messages were delivered virtually and only once a week and Bandura (1997) suggests that messages are strongest when they are specific and proximate to activity, which not necessarily achieved with this study. The messages were based upon mastery experience as well as verbal persuasion sources of influence, but not directly connected to a walking event performed by the participant. In addition, because

there was not a significant difference in self-efficacy beliefs between groups, the messages may not have been as specific as they could have been and thus additional research into message development needs to occur. Further exploration into the time of delivery, number of messages and frequency of messages is important in order to assess if there is a stronger effect of self-efficacy text messages upon beliefs and behavior than what was found in the study.

Because of the changes introduced by the Affordable Care Act, these studies focused on ways to increase and sustain walking for exercise in a female healthcare worksite population. Based upon participant responses, the ability to perform the walking behavior anywhere as well as the virtual connection to the participants, this study design could be implemented with other populations outside of the worksite. Future research employing smartphone apps and text-message based self-efficacy messages could be used with health coaching through insurance companies, community groups or weight-loss clubs. Because of the small effect found with the sustainability study, further development of the intervention needs to occur. There should also be consideration in combining the smartphone app and messages with other interventions for a multifaceted approach.

## Conclusion

These studies set the groundwork for future research on the use of the self-efficacy theory to build and deliver messages around walking for exercise in a healthcare worksite population. Although the walking behavior was not sustainable past 5 weeks for those who received the text messages, there is value in future research in how to couple self-efficacy theory based text messages and smartphone apps with other interventions to

create comprehensive worksite and wellness programs. Research should continue testing innovative ways to deliver self-efficacy theory based messages as well as the use of smartphone apps to track behavior and inspire walking in an inactive population.

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# APPENDIX A

# WALKING SELF-EFFICACY SCALE SHORT FORM

# WALKING SELF-EFFICACY SCALE SHORT FORM

Level of Confidence Scale:

0 10 20 30 40 50 60 70 80 90 100

No Confidence Moderate Confidence Extremely Confident

**Instructions:** Please place the number that best represents your estimation of your **Level of Confidence** on the above scale regarding your ability to perform the following activities at a moderate intensity level under the following conditions:

Activity #1: Walking for exercise the distance of…

_____1. One block.

_____2. One mile.

_____3. Three miles.

Activity #2: Walking for exercise on…

_____4. Even terrain like at the park.

_____5. A few moderately steep hills.

_____6. Numerous and fairly steep hills.

Activity #3. Walking for exercise…

_____7. In sunny and calm weather.

_____8. In cloudy and windy or cold weather.

_____9. In wet and rainy weather.

Activity #4. Exercise by…

_____10. Hiking one mile.

_____11. Jogging one mile.

_____12. Running one mile.

# APPENDIX B

# STRUCTURED INTERVIEW QUESTIONS

# STRUCTURED INTERVIEW QUESTIONS – PILOT STUDY

1. Do you feel differently about going for a 1-mile walk for exercise following the walk we just took?
2. Why?
3. How confident are you in your ability to repeat the walk we did (here or at home) at a moderate level of intensity?
4. Is that confidence different than it was before you arrived to the study today?
5. Why? What changed?
6. How likely are you to continue walking at a moderate intensity level after today and why?

# APPENDIX C

## PHYSICAL ACTIVITY READINESS QUESTIONAIRE (PAR-Q)

Physical Activity Readiness
Questionnaire - PAR-Q
(revised 2002)

# PAR-Q & YOU

**(A Questionnaire for People Aged 15 to 69)**

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

| YES | NO | | |
|---|---|---|---|
| ☐ | ☐ | 1. | **Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?** |
| ☐ | ☐ | 2. | **Do you feel pain in your chest when you do physical activity?** |
| ☐ | ☐ | 3. | **In the past month, have you had chest pain when you were not doing physical activity?** |
| ☐ | ☐ | 4. | **Do you lose your balance because of dizziness or do you ever lose consciousness?** |
| ☐ | ☐ | 5. | **Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?** |
| ☐ | ☐ | 6. | **Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?** |
| ☐ | ☐ | 7. | **Do you know of any other reason why you should not do physical activity?** |

## If you answered YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

## NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

**DELAY BECOMING MUCH MORE ACTIVE:**

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

**PLEASE NOTE:** If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.



NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

**Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.**



Supported by: Health Canada Santé Canada

continued on other side...

...continued from other side

# PAR-Q & YOU

Physical Activity Readiness Questionnaire - PAR-Q (revised 2002)

CANADA'S Physical Activity Guide to Healthy Active Living

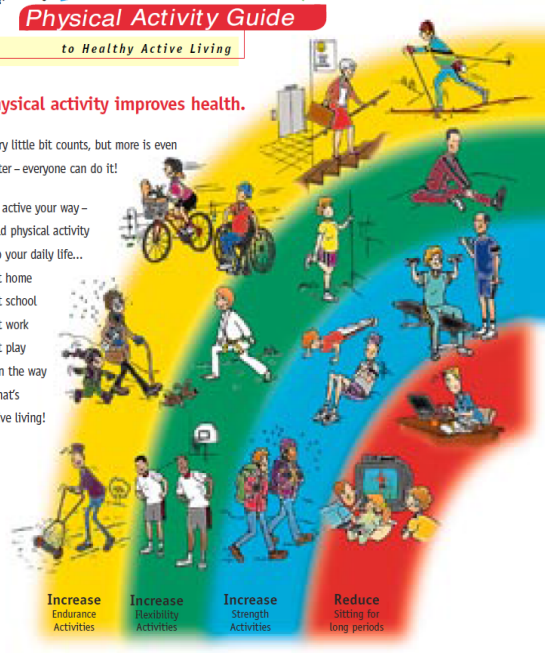
## Physical activity improves health.

Every little bit counts, but more is even better – everyone can do it!

Get active your way – build physical activity into your daily life...

- at home
- at school
- at work
- at play
- on the way

...that's active living!




**Choose a variety of activities from these three groups:**

**Endurance**
4-7 days a week
Continuous activities for your heart, lungs and circulatory system.

**Flexibility**
4-7 days a week
Gentle reaching, bending and stretching activities to keep your muscles relaxed and joints mobile.

**Strength**
2-4 days a week
Activities against resistance to strengthen muscles and bones and improve posture.

Starting slowly is very safe for most people. Not sure? Consult your health professional.

For a copy of the *Guide Handbook* and more information: **1-888-334-9769**, or **www.paguide.com**

Eating well is also important. Follow *Canada's Food Guide to Healthy Eating* to make wise food choices.

## Get Active Your Way, Every Day – For Life!

Scientists say accumulate 60 minutes of physical activity every day to stay healthy or improve your health. As you progress to moderate activities you can cut down to 30 minutes, 4 days a week. Add-up your activities in periods of at least 10 minutes each. Start slowly... and build up.

**Time needed depends on effort**

| Very Light Effort | Light Effort *60 minutes* | Moderate Effort *30-60 minutes* | Vigorous Effort *20-30 minutes* | Maximum Effort |
|---|---|---|---|---|
| • Strolling<br>• Dusting | • Light walking<br>• Volleyball<br>• Easy gardening<br>• Stretching | • Brisk walking<br>• Biking<br>• Raking leaves<br>• Swimming<br>• Dancing<br>• Water aerobics | • Aerobics<br>• Jogging<br>• Hockey<br>• Basketball<br>• Fast swimming<br>• Fast dancing | • Sprinting<br>• Racing |

Range needed to stay healthy

**You Can Do It – Getting started is easier than you think**

Physical activity doesn t have to be very hard. Build physical activities into your daily routine.

- Walk whenever you can – get off the bus early, use the stairs instead of the elevator.
- Reduce inactivity for long periods, like watching TV.
- Get up from the couch and stretch and bend for a few minutes every hour.
- Play actively with your kids.
- Choose to walk, wheel or cycle for short trips.
- Start with a 10 minute walk – gradually increase the time.
- Find out about walking and cycling paths nearby and use them.
- Observe a physical activity class to see if you want to try it.
- Try one class to start – you don t have to make a long-term commitment.
- Do the activities you are doing now, more often.

| Benefits of regular activity: | Health risks of inactivity: |
|---|---|
| • better health<br>• improved fitness<br>• better posture and balance<br>• better self-esteem<br>• weight control<br>• stronger muscles and bones<br>• feeling more energetic<br>• relaxation and reduced stress<br>• continued independent living in later life | • premature death<br>• heart disease<br>• obesity<br>• high blood pressure<br>• adult-onset diabetes<br>• osteoporosis<br>• stroke<br>• depression<br>• colon cancer |

Health Canada Santé Canada

Canadian Society for Exercise Physiology



Source: Canada's Physical Activity Guide to Healthy Active Living, Health Canada, 1998 http://www.hc-sc.gc.ca/hppb/paguide/pdf/guideEng.pdf



**FITNESS AND HEALTH PROFESSIONALS MAY BE INTERESTED IN THE INFORMATION BELOW:**

The following companion forms are available for doctors' use by contacting the Canadian Society for Exercise Physiology (address below):

The **Physical Activity Readiness Medical Examination (PARmed-X)** – to be used by doctors with people who answer YES to one or more questions on the PAR-Q.

The **Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy)** – to be used by doctors with pregnant patients who wish to become more active.

References:

Arraix, G.A., Wigle, D.T., Mao, Y. (1992). Risk Assessment of Physical Activity and Physical Fitness in the Canada Health Survey Follow-Up Study. **J. Clin. Epidemiol.** 45:4 419-428.

Mottola, M., Wolfe, L.A. (1994). Active Living and Pregnancy, In: A. Quinney, L. Gauvin, T. Wall (eds.), **Toward Active Living: Proceedings of the International Conference on Physical Activity, Fitness and Health**. Champaign, IL: Human Kinetics.

PAR-Q Validation Report, British Columbia Ministry of Health, 1978.

Thomas, S., Reading, J., Shephard, R.J. (1992). Revision of the Physical Activity Readiness Questionnaire (PAR-Q). **Can. J. Spt. Sci.** 17:4 338-345.

For more information, please contact the:

Canadian Society for Exercise Physiology
202-185 Somerset Street West
Ottawa, ON K2P 0J2
Tel. 1-877-651-3755 • FAX (613) 234-3565
Online: www.csep.ca

The original PAR-Q was developed by the British Columbia Ministry of Health. It has been revised by an Expert Advisory Committee of the Canadian Society for Exercise Physiology chaired by Dr. N. Gledhill (2002).

Disponible en français sous le titre «Questionnaire sur l'aptitude à l'activité physique - Q-AAP (revisé 2002)».



Supported by: Health Canada Santé Canada

# APPENDIX D

# WALKING SELF-EFFICACY SCALE

WALKING SELF-EFFICACY SCALE

Level of Confidence Scale:

0 10 20 30 40 50 60 70 80 90 100

No Confidence Moderate Confidence Extremely Confident

**Instructions:** Please place the number that best represents your estimation of your **Level of Confidence** on the above scale regarding your ability to perform the following activities under the following conditions:

Activity #1: Walking for exercise the distance of…

_____1. One block.

_____2. One mile.

_____3. Three miles.

Activity #2: Walking for exercise on…

_____4. Even terrain like at the park.

_____5. A few moderately steep hills.

_____6. Numerous and fairly steep hills.

Activity #3. Walking for exercise…

_____7. In a quiet neighborhood with very little traffic.

_____8. In a neighborhood on streets with moderate commuter traffic.

_____9. In a congested city with a lot of traffic and noise.

Activity #4. Walking for exercise…

_____10. In sunny and calm weather.

_____11. In cloudy and windy or cold weather.

_____12. In wet and rainy weather.

Activity #5. Walking for exercise while…

_____13. Just a bit stressed.

_____14. Moderately stressed.

_____15. Highly stressed.

Activity #6. Walking for exercise when…

_____16. Feeling rested and well.

_____17. Feeling a little tired.

_____18. Feeling very tired.

Activity #7. Exercise by…

_____19. Hiking one mile.

_____20. Jogging one mile.

_____21. Running one mile.

# APPENDIX E

# PHYSICAL ACTIVITY GENERALIZABILITY SCALE

# PHYSICAL ACTIVITY GENERALIZABILITY SCALE

For the questions below, please answer on a scale of 0 to 100 where 0 is “not very likely” and 100 is “very likely”, for any day of the week, how likely are you to:

_____ 1) Go for a moderate intensity 30 minute or more walk?

_____2) Go for a moderate intensity 30 minute or more jog or run?

_____3) Perform a moderate intensity 30 minute or more form of physical activity such as cycling, skiing, skateboarding, weight lifting, aerobics, yoga, Pilates, etc?